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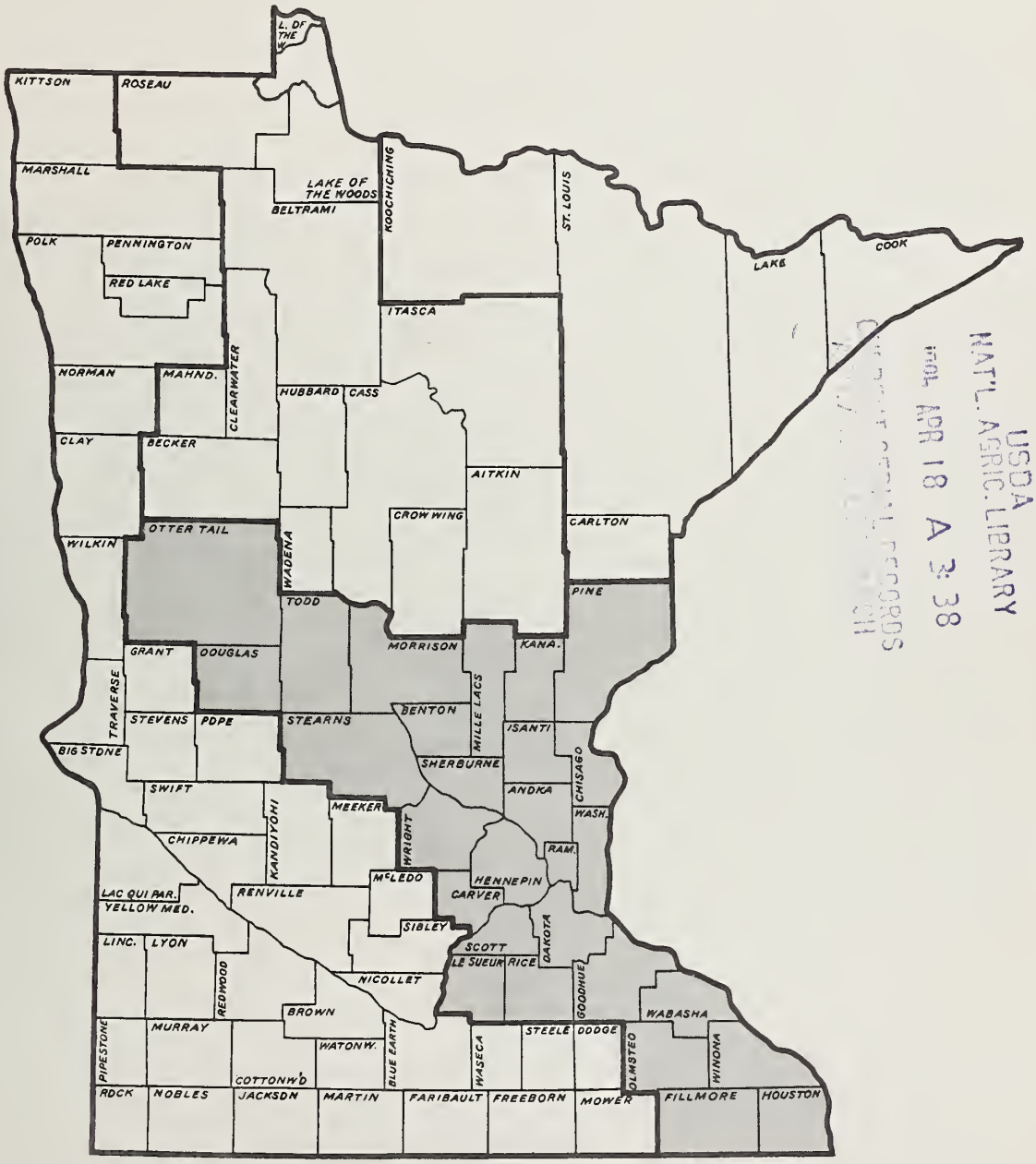
Timber resource of Minnesota's central hardwood unit, 1977.

Alexander Vasilevsky and Ronald L. Hackett



North Central Forest Experiment Station
Forest Service, U.S. Department of Agriculture

North Central Forest Experiment Station
Forest Service - U.S. Department of Agriculture
1992 Folwell Avenue
St. Paul, Minnesota 55108
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FOREWORD

Resources Evaluation (formerly called Forest Survey) is a continuing endeavor as mandated by the Forest and Rangeland Renewable Resources Planning Act of 1974 which was preceeded by the McSweeney-McNary Forest Research Act of 1928. Its objective is to periodically inventory the Nation's forest land to determine its extent, condition, and volume of timber, growth, and depletions. This kind of up-to-date information is essential to frame intelligent forest policies and programs. USDA Forest Service regional experiment stations are responsible for conducting these inventories and publishing summary reports for individual States. The North Central Forest Experiment Station is responsible for Resources Evaluation work done in Michigan, Wisconsin, Minnesota, North Dakota, and eastern South Dakota (east of 103rd meridian), Nebraska, Iowa, Illinois, Indiana, Missouri, and Kansas.

Fieldwork for the 1977 Minnesota Forest Survey began in July, 1974 and was completed in July, 1978. Reports on the three previous surveys of Minnesota's timber resource are dated 1936, 1953, and 1962.

Similar Resource Bulletins containing statistical highlights and detailed tables on the timber resource of the other Survey Units in Minnesota (see cover) are also available. These will provide the basis for a comprehensive analysis of the timber resource of the entire State which will be published as a separate report.

More accurate survey information was obtained during the 1977 survey than otherwise would have been feasible because of intensified field sampling made possible by funding and manpower provided the North Central Station by the State Legislature through the Minnesota Department of Natural Resources. The Department also assisted in a canvass of primary wood-using plants in the State, which was used to help estimate the quantity of timber products harvested in Minnesota.

Aerial photos used in the Central Hardwood Unit survey were furnished by the Minnesota Department of Natural Resources and the USDA Agricultural Stabilization and Conservation Service.

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TIMBER RESOURCE OF MINNESOTA'S CENTRAL HARDWOOD UNIT, 1977

Alexander Vasilevsky, *Mensurationist,*
and **Ronald L. Hackett,** *Mensurationist*

HIGHLIGHTS

Forest Area

- Forest land occupied 2.1 million acres in 1977 (18 percent of the Unit's land area) as compared to 2.7 million acres (23 percent) in 1962.[1]
- Commercial forest land declined 17 percent from 2.4 million acres in 1962 (86 percent of total forest area) to 2.0 million acres in 1977 (91 percent of the total forest area).
- Pine and Ottertail Counties contain the Unit's largest areas of commercial forest (425,000 and 186,000 million acres, respectively).
- Eighty-three percent (1.6 million acres) of the commercial forest land in the Unit is privately owned. Farmers alone own 58 percent (1.1 million acres) (fig. 1).
- The oak type (571,800 acres), aspen type (560,200), and maple-basswood type (485,800) contain the largest areas in 1977. In 1962 the aspen type (640,000), oak type (600,300), and elm-ash-cottonwood type (414,000) led all others.
- Poletimber stands account for 43 percent of the commercial forest and sawtimber stands account for 40 percent.

[1] *1962 statistics have been adjusted from those published after the 1962 survey to conform to 1977 statistics because of changes in survey unit boundaries and in procedures and definitions. (See Comparing Minnesota's Fourth Forest Survey with the Third Survey in Appendix).*

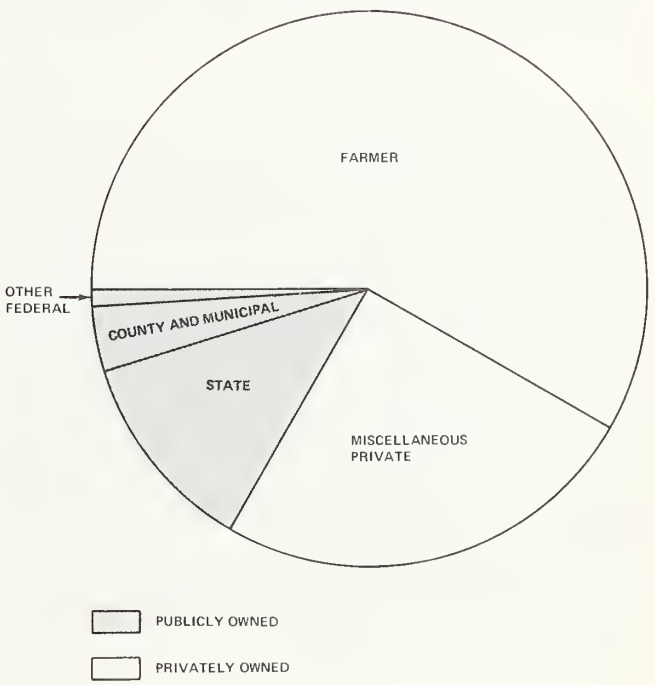

Figure 1.—*Distribution of commercial forest land by ownership class, Central Hardwood Unit, Minnesota, 1977.*

Timber Volume

- Even though commercial forest area declined between surveys, growing-stock volume spurted from 1.2 billion cubic feet in 1962 to 1.5 billion cubic feet in 1977 (a 31 percent gain) (fig. 2).

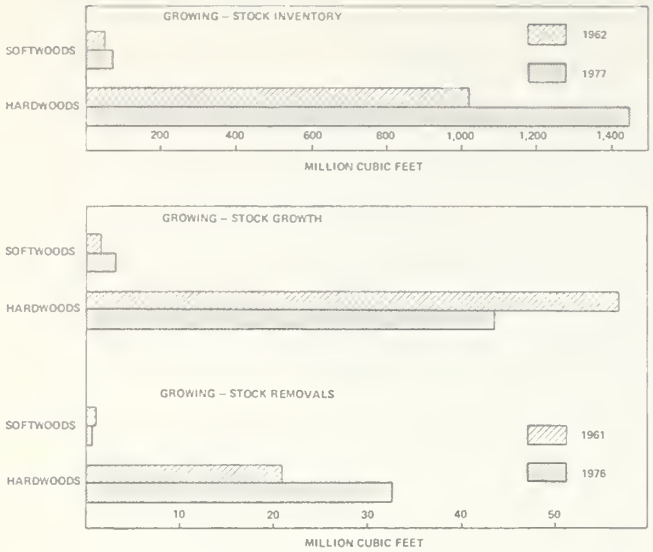

Figure 2.—*Growing-stock inventory, net annual growth and removals, by softwoods and hardwoods, Central Hardwood Unit, Minnesota, 1962 to 1977.*

- Sawtimber volume increased from 2.6 billion board feet in 1962 to 4.6 billion board feet in 1977.
- Pine County contains the largest growing-stock volume—299 million cubic feet (19 percent of the Unit total).
- Select red oaks (327 million cubic feet) and aspen (284 million) account for the largest volumes of growing stock.
- Thirty-seven percent of the growing-stock volume is in stands aged 41 to 60 years.
- The average growing-stock volume per acre is 793 cubic feet (10.0 cords per acre).
- The volume of cull trees (rough, rotten, and short-log) is 220 million cubic feet; salvable dead trees total 13 million cubic feet.

Stand Conditions

- Net annual growth on growing-stock trees was 62 million cubic feet (788,500 million cords) in 1976, compared with 46 million cubic feet (581,000 million cords) in 1961.
- Net annual growth rate of growing stock was 4.0 percent of inventory. The softwood growth rate (4.7 percent) was higher than the hardwood rate (4.0 percent).
- Net growth averaged 31.9 cubic feet per acre in 1976, compared with 19.4 in 1961.
- Average annual mortality of growing-stock trees was 17 million cubic feet in 1976; half of it attributable to disease.
- The growing-stock mortality rate averaged 1.1 percent of inventory in 1976.
- Seventy percent of the commercial forest area is capable of growing trees 50 feet and taller at age 50, but only 14 percent is capable of growing trees 70 feet and taller at the same age.
- Forty-eight percent of the commercial forest is composed of stands 50 years of age or younger.

Timber Use

- Timber removals[2] from growing stock totaled 34 million cubic feet (432,900 cords) in 1976. Softwoods contributed 1 million cubic feet and hardwoods 33 million.
- Timber removals from growing stock in 1976 represented a 51 percent increase over removals in 1962 (23 million cubic feet).
- Pine County contributed 12 percent of the growing-stock removals (4.0 million cubic feet) and Mille Lacs County accounted for 10 percent (3.5 million cubic feet).
- Ninety-six percent of the growing-stock removals came from private, nonindustrial lands.
- Timber products output totaled 18.5 million cubic feet in 1975; 8.1 million cubic feet in fuelwood alone.
- Primary plant residue totaled 2.3 million cubic feet in 1975, including 0.3 million cubic feet that were not utilized.

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[2]*Removals in 1976 are trend level removals. "Other" removals from transfer of commercial forest land to productive-reserved are not included in 1976 removals.*

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PRINCIPAL TREE SPECIES IN MINNESOTA'S CENTRAL HARDWOOD UNIT[3]

SOFTWOOD SPECIES:

Eastern white pine ..... *Pinus strobus*
Red pine ..... *Pinus resinosa*
Jack pine ..... *Pinus banksiana*
Black spruce ..... *Picea mariana*
White spruce ..... *Picea glauca*
Balsam fir ..... *Abies balsamea*
Tamarack ..... *Larix laricina*
Northern white-cedar ..... *Thuja occidentalis*
Other softwoods:
Eastern redcedar ..... *Juniperus virginiana*

HARDWOOD SPECIES:

White oaks:
White oak ..... *Quercus alba*
Swamp white oak ..... *Quercus bicolor*
Bur oak ..... *Quercus macrocarpa*
Select red oaks:
Northern red oak ..... *Quercus rubra*
Other red oaks:
Northern pin oak ..... *Quercus ellipsoidalis*
Black oak ..... *Quercus velutina*
Hickories:
Butternut hickory ..... *Carya cordiformis*
Shagbark hickory ..... *Carya ovata*
Yellow birch ..... *Betula alleghaniensis*
Hard maples:
Sugar maple ..... *Acer saccharum*
Black maple ..... *Acer nigrum*
Soft maples:
Red maple ..... *Acer rubrum*
Silver maple ..... *Acer saccharinum*
Ashes:
White ash ..... *Fraxinus americana*
Black ash ..... *Fraxinus nigra*
Green ash ..... *Fraxinus pennsylvanica*
Balsam poplar ..... *Populus balsamifera*
Paper birch ..... *Betula papyrifera*
Bigtooth aspen ..... *Populus grandidentata*
Quaking aspen ..... *Populus tremuloides*
Basswood ..... *Tilia americana*
Elms:
American elm ..... *Ulmus americana*
Slippery elm ..... *Ulmus rubra*
Rock elm ..... *Ulmus thomasii*
Select hardwoods:
Butternut ..... *Juglans cinerea*
Black walnut ..... *Juglans nigra*
Black cherry ..... *Prunus serotina*
Other hardwood:
Boxelder ..... *Acer negundo*
River birch ..... *Betula nigra*
Hackberry ..... *Celtisi occidentalis*
Kentucky coffeetree ..... *Gymnocladus dioicus*
Eastern cottonwood ..... *Populus deltoides*
Black willow ..... *Salix nigra*

[3] *The common and scientific names are based on: Little, Elbert L., Jr. 1953. Check list of native and naturalized trees of the United States (including Alaska). U.S. Dep. Agric., Agric. Handb. 41, 472 p.*

APPENDIX

ACCURACY OF SURVEY

Resources Evaluation information is based on a sampling procedure designed to provide reliable statistics at the State and Survey Unit levels. Consequently, the reported figures are only estimates. However, a measure of reliability of these figures is given by sampling errors. These sampling errors may be interpreted as meaning that the chances are two out of three that if a 100-percent inventory had been taken, using the same methods, the results would have been within the limits indicated.

For example, the estimated area of commercial forest land in the Central Hardwood Unit in 1977, 1,951.1 thousand acres, has a sampling error of ± 1.45 percent (± 28.3 thousand acres). The chances are two out of three that the commercial forest area from a 100-percent inventory, then, would be expected to fall between 1,979.4 and 1,922.8 thousand acres (1,951.1 ± 28.3).

The following sampling errors are for total estimated volume, net growth, and removals for both growing stock and sawtimber, and for area of commercial forest land during the 1977 Central Hardwood Unit survey:

Item	Central Hardwood Unit totals	Sampling error (percent)
Growing stock:		
Volume	1.5 billion cubic feet	2.10
Growth	62.3 million cubic feet	3.02
Removals	34.2 million cubic feet	8.57
Sawtimber:		
Volume	4.5 billion board feet	3.01
Growth	205.9 million board feet	3.26
Removals	82.0 million board feet	7.70
Commercial forest land:	1.9 million acres	1.45

As survey data are broken down into units smaller than State or Survey Unit totals, the sampling error increases (table 54). The smaller the breakdown, the larger the sampling error. For example, the sampling error for area of commercial forest land in a particular county is higher than that for total commercial forest area in the Survey Unit.

SURVEY PROCEDURE

The major steps in the survey of the Central Hardwood Unit were as follows:

1. A total of 65,328 l-acre points distributed systematically across aerial photos of the entire area, were observed. To make a preliminary estimate of forest area these points were classified as either forest land (12,819), unproductive forest land (36), nonforest land (52,332), or questionable (141). Next, all 12,819 of the forest points, 5 unproductive forest points, and all 141 of the questionable points were stereoclassified as to forest type, stand-size class, and density. Then 1,679 points classed as forest, 5 points classed as unproductive, 21 points classed as questionable, and 7,122 points classed as nonforest were examined on the ground to correct the preliminary area estimate for errors in classification and for actual changes in land use since the photos were taken. At each of the 1,362 commercial forest locations, 10 variable-radius plots (basal area factor 37.5) were established uniformly over the sample acre. Tree measurements made on these plots were the basis for estimates of timber volume, growth, mortality, number of trees, and other forest classifications.

2. Growth and mortality on all commercial forest land were estimated using the Forest Resources Evaluation Program (FREP)[4]; which is an individual tree-growth projection system that uses stand characteristics such as tree diameter to estimate tree volumes.

3. Statistics on timber utilization during 1975 were obtained from mill surveys. The Minnesota Department of Natural Resources and the North Central Forest Experiment Station canvassed resident sawmills, veneer mills, and other primary wood-using plants. The North Central Forest Experiment Station canvassed resident pulpmills as well as out-of-State sawmills, pulpmills, and veneer mills to

[4]*For more information on FREP, see: U.S. Department of Agriculture, Forest Service. 1979. A generalized forest growth projection system for the Lake States Region. U.S. Department of Agriculture Forest Service, General Technical Report NC-49, 96 p. U.S. Department of Agriculture Forest Service, North Central Forest Experiment Station, St. Paul, Minnesota.*

determine their use of timber from Minnesota. Fuelwood and fencepost output was based on a sample of private landowners to determine their production of fuelwood and fenceposts and on a canvass of industrial and public timber owners. Estimates of primary mill residue used for fuelwood were obtained from the canvass of Minnesota primary wood-using plants. Timber cut for products by ownership class was determined by a canvass of all public and industrial timber owners. The portion of timber cut unaccounted for by the latter owners was grouped under "farmer and other owners".

4. To develop wood utilization factors used in converting timber products output to timber removals for saw logs and pulpwood, 1,028 felled trees throughout the State were measured during 1975-1976. Factors for veneer logs were obtained during the 1967-1968 Wisconsin utilization study. Factors for all other products were obtained during the 1960-1961 Minnesota utilization study.

5. Field data were sent to St. Paul, Minnesota, for compilation.

COMPARING MINNESOTA'S FOURTH FOREST SURVEY WITH THE THIRD SURVEY

Data from new forest surveys are often compared with data from earlier forest surveys to determine trends in forest areas and volumes. Changes in procedures and definitions between surveys make it necessary to adjust earlier survey data so they are comparable to data from the new survey.

In Minnesota's Central Hardwood Unit, published 1962 commercial forest area was adjusted to take into account changes in the Unit boundaries between surveys and changes in survey methods. The result, an adjusted 1962 commercial forest area, appears in the tables presented in this report.

Original estimates of 1962 inventory, growth, mortality, and removals were based on the original, unadjusted 1962 commercial forest area. However, because the 1962 commercial forest area was adjusted to take into account changes in survey methods, the estimates of inventory, growth, mortality, and removals for the year must also reflect these changes.

A test was made to ensure that it was possible to move from the adjusted 1962 volumes to the new 1977 volumes by means of Timber Resource Analysis System (TRAS), a Forest Service computer program for updating, backdating, and projecting timber volume, growth, mortality, and removals. In order for the program to work most effectively, the 2 years to be reconciled must have comparable commercial forest land bases so that changes in volumes between surveys reflect actual changes in forest conditions or land use. To achieve this condition it was necessary to make further adjustments in 1962 data so that land transferred from commercial forest to productive-reserved between the two surveys does not appear in the 1962 land base. If this adjustment were not made, removals between 1962 and 1977 would appear artificially high in order to absorb the loss of timber from this change in land status. This adjustment is made for the test only; area and volumes removed for the test are added back into the 1962 reported data.

TRAS recalculated 1962 volumes using 1977 estimates of cubic foot volume per tree and 1977 board foot-cubic foot ratios. This volume adjustment was necessary so that differences in volumes between surveys represent actual change and not merely change in the volume equations used on each occasion.

Removals estimates for 1962 and 1977 are for total removals, including timber cut in addition to "other" removals and are trend level removals. "Other" removals from transfer of commercial forest land to other land uses are not included. Published 1960 estimates are of timber cut only, and do not include "other" removals. TRAS generated an estimate of what "other" removals must have been in 1962 to provide the adjusted 1962 total removals.

When the final adjustments of 1962 data were completed, the resulting 1962 volumes and area were distributed among the four Survey Units. A check was made by hand to ensure that it was possible to move from the adjusted 1962 volumes to the new 1977 volumes in each Unit. This was done using the average periodic difference between growth and removals for the two surveys and applying this difference to the 1962 volume. Next, the same procedure was repeated for each individual species within each Unit to make certain inventory volumes reported for each species were consistent with reported growth and removals volumes.

METRIC EQUIVALENTS OF UNITS USED IN THIS REPORT

1 acre = 4,046.86 square meters or 0.405 hectare.
1,000 acres = 405 hectares
1,000 board feet (International ¼-inch log rule) = 3.48 cubic meters.
Breast height = 1.4 meters above the ground.
1 cubic foot = 0.0283 cubic meter.
1 foot = 30.48 centimeters or 0.3048 meter.
1 inch = 25.4 millimeters or 2.54 centimeters or 0.0254 meter.

DEFINITION OF TERMS

Land-Use Classes

Gross area.—The entire area of land and water as determined by the Bureau of Census, 1970.

Land area.—The area of dry land and land temporarily or partially covered by water such as marshes, swamps, floods plains, streams, sloughs, and estuaries. Canals less than ⅛-mile wide, and lakes, reservoirs, and ponds smaller than 40 acres are included as land area. These figures are from the Bureau of Census, 1970.

Forest land.—Land at least 16.7 percent stocked by forest trees of any size, or formerly having such tree cover, and not currently developed for nonforest use. Includes afforested areas. The minimum forest area classified was 1 acre. Roadside, streamside, and shelterbelt strips of timber must have a crown width of at least 120 feet to qualify as forest land. Unimproved roads and trails, streams, and clearings in forest areas were classed as forest if less than 120 feet wide.

Commercial forest land.—Forest land that is producing or is capable of producing crops of industrial wood and that is not withdrawn from timber utilization by statute or administrative regulation. This includes areas suitable for management to grow crops of industrial wood generally of a site quality capable of producing in excess of 20 cubic feet per acre of annual growth. This includes both inaccessible and inoperable areas.

Noncommercial forest land.—(a) Unproductive—forest land incapable of yielding crops of industrial wood because of adverse site conditions, (b) Productive-reserved—forest land withdrawn from commercial timber use through statute or administrative regulation or exclusively used for Christmas tree production.

Nonforest land.—Land that has never supported forests, and land formerly forested where forest use is precluded by development for nonforest uses, such as cropland, improved pasture, residential areas, and city parks. Also includes improved roads and adjoining rights-of-way, powerline clearings, and certain areas of water classified by the Bureau of Census as land. Unimproved roads, streams, canals, and nonforest strips in forest areas must be more than 120 feet wide, and clearings in forested areas must be more than 1 acre in size, to qualify as nonforest land.

Ownership Classes

National forest.—Federal land that has been designated by executive order or statute as National Forests or purchase units, and other land under the administration of the USDA Forest Service.

Other Federal.—Federal land other than National Forest.

State, county, and municipal.—Land owned by States, counties, or local public agencies, or land leased by them for more than 50 years.

Forest industry.—Land owned by companies or individuals operating primary wood-using plants.

Farmer-owned.—Land owned by operators of farms. A farm must include 10 or more acres from which the sale of agricultural products totals $50 or more annualy, or if less than 10 acres, the yield must be at least $250 annually.

Farmer-owned, leased.—Land owned by an operator of a farm but leased to another party.

Miscellaneous private-corporation.—Land owned by a private corporation not in the business of operating primary wood-using plants.

Miscellaneous private-individual.—Land owned by a private individual.

Miscellaneous private-corporation, leased.—Land owned by a private corporation but leased to another party.

Miscellaneous private-individual, leased.—Land owned by a private individual but leased to another party.

Tree Classes

All live trees—Growing-stock, rough, and rotten trees 1 inch d.b.h. and larger.

Growing-stock trees.—All live trees of commercial species except rough and rotten trees.

Desirable trees.—Growing-stock trees having no serious defects in quality limiting present or prospective use, and of relatively high vigor and containing no pathogens that kill or seriously deteriorate them before rotation age. These are trees that would be favored by forest managers in silvicultural operations.

Acceptable trees.—Trees meeting the standards for growing stock but not qualifying as desirable trees.

Sawtimber trees.—Growing-stock trees of commercial species containing at least a 12-foot saw log or two noncontiguous saw logs, each 8 feet or longer. At least 33 percent of the gross volume of the tree must be sound wood. Softwoods must be at least 9.0 inches d.b.h. and hardwoods must be at least 11.0 inches.

Poletimber trees.—Growing-stock trees of commercial species at least 5.0 inches d.b.h. but smaller than sawtimber size and of good form and vigor.

Saplings.—Live trees of commercial species 1.0 to 5.0 inches d.b.h. and of good form and vigor.

Seedlings.—Live trees of commercial species less than 1.0 inch d.b.h. that are expected to survive according to regional standards. (Examples of seedlings not expected to survive are those that are diseased or heavily damaged by logging, browsing, or fire.) Only softwood seedlings more than 6 inches and hardwood seedlings more than 1 foot tall are counted.

Rotten trees.—Live trees (any size) of commercial species that do not contain a merchantable 12-foot saw log or two noncontiguous 8-foot or longer saw logs, now or prospectively, because of rot (that is, when more than 50 percent of the cull volume of the tree is rotten).

Rough trees.—Live trees that do not contain at least one merchantable 12-foot saw log or two noncontiguous 8-foot or longer saw logs, now or prospectively, because of roughness and poor form, as well as all live noncommercial species.

Short-log (rough trees).—Sawtimber-sized trees of commercial species that contain at least one merchantable 8- to 11-foot saw log but not a 12-foot saw log.

Stocking

The degree of utilization of land by trees as measured in terms of basal area and/or the number of trees in a stand compared to the basal area and/or number of trees required to fully utilize the growth potential of the land.

A stocking percent of 100 indicates full utilization of the site and is equivalent to 80 square feet of basal area per acre in trees 5 inches d.b.h. and larger. In a stand of trees less than 5 inches d.b.h., a stocking percent of 100 would indicate that the present number of trees is sufficient to produce 80 square feet of basal area per acre when the trees reach 5 inches d.b.h.

Stocking of all live trees, growing-stock trees, and desirable trees are recorded separately and stands are grouped into the following stocking classes.

Stocking Classes

Overstocked stands.—Stands in which stocking of trees is 133 percent or more.

Fully-stocked stands.—Stands in which stocking of trees is from 100 to 133 percent.

Medium-stocked stands.—Stands in which stocking of trees is from 60 to 100 percent.

Poorly-stocked stands.—Stands in which stocking of trees is from 16.7 to 60 percent.

Nonstocked areas.—Commercial forest land on which stocking of trees is less than 16.7 percent.

Stand-Size Classes

Stand.—A growth of trees on a minimum of 1 acre of forest land that is stocked by forest trees of any size.

Sawtimber stands.—Stands at least 16.7 percent stocked with growing-stock trees, with half or more of this stocking in sawtimber or poletimbr trees and with sawtimber stocking at least equal to poletimber stocking.

Poletimber stands.—Stands at least 16.7 percent stocked with growing-stock trees, and with half or more of this stocking in sawtimber and/or poletimber trees and with poletimber stocking exceeding that of sawtimber.

Sapling-seedling stands.—Stands at least 16.7 percent stocked with growing-stock trees and with saplings and/or seedlings comprising more than half of this stocking.

Nonstocked areas.—Commercial forest land on which stocking of growing-stock trees is less than 16.7 percent.

Other Classifications

Site index.—An expression of forest site quality based on the height of a free-growing dominant or codominant tree of a representative species in the forest type at age 50.

Site classes.—A classification of forest land in terms of inherent capacity to grow crops of industrial wood expressed in cubic-foot growth per acre per year.

Stand-age.—Age of the main stand. Main stand refers to trees of the dominant forest type and stand-size class.

Basal area.—The area in square feet of the cross section at breast height of a single tree. When the basal area of all the trees in a stand are summed, the result is usually expressed as square feet of basal area per acre.

Forest Types

A classification of forest land based upon the species forming a plurality of live-tree stocking. Major forest types in Minnesota are:

Jack pine.—Forests in which jack pine comprises a plurality of the stocking. (Common associates include eastern white pine, red pine, aspen, birch, and maple.)

Red pine.—Forests in which red pine comprises a plurality of the stocking. (Common associates include eastern white pine, jack pine, aspen, birch, and maple).

White pine.—Forests in which eastern white pine comprises a pluraity of the stocking. (Common associates include red pine, jack pine, aspen, birch, and maple.)

Balsam fir.—Forests in which balsam fir comprises a plurality of stocking. (Common associates include white spruce, aspen, maple, birch, northern white-cedar, and tamarack.)

White spruce.—Forests in which white spruce comprises a plurality of the stocking. (Common associates include balsam fir, aspen, maple, birch, northern white-cedar, tamarack.)

Black spruce.—Forests in which swamp conifers (black spruce, tamarack, and northern white-cedar) comprise a plurality of the live-tree stocking, with black spruce the most common.

Northern white-cedar.—Forests in which swamp conifers comprise a plurality of live tree stocking, with northern white-cedar the most common.

Tamarack—Forests in which swamp conifers comprise a pluraity of live-tree stocking, with tamarack the most common.

Oak.—Forests in which northern red oak, white oak, or bur oak, singly or in combination, comprise a plurality of the stocking. (Common associates include elm, maple, and aspen.)

Elm-ash-cottonwood.—Forests in which lowland elm, ash, cottonwood, and red maple, singly or in combination, comprise a plurality of the stocking. (Common associates include basswood and balsam poplar.)

Maple-basswood.—Forests in which sugar maple, basswood, yellow birch, upland American elm, and red maple, singly or in combination, comprise a plurality of the stocking. (Common associates include white pine and elm.)

Aspen.—Forests in which quaking aspen or bigtooth aspen, singly or in combination, comprise a plurality of the stocking. (Common associates include balsam poplar, balsam fir, and paper birch.)

Paper birch.—Forests in which paper birch comprises a plurality of the stocking. (Common associates include maple, aspen, and balsam fir.)

Balsam poplar.—Forests in which balsam poplar comprises a plurality of the stocking. (Common associates include aspen, elm, and ash.)

Timber Volume

Volume of growing stock.—The volume of sound wood in the bole of growing-stock trees 5.0 inches d.b.h. and over, from a 1-foot stump to a minimum of 4.0-inch top diameter outside bark, or to the point where the central stem breaks into limbs. Growing-stock volumes are shown in cubic feet. Conversion to cords may be accomplished by a factor of 79 cubic feet per solid wood cord.

Volume of sawtimber.—Net volume of saw log portion of live sawtimber trees in board feet, International ¼-inch rule, from stump to a minimum 7 inches top diameter outside bark for softwoods and 9 inches for hardwoods.

Upper stem portion.—That part of the bole of sawtimber trees above the merchantable sawtimber top to a minimum top diameter of 4.0 inches outside bark or to the point where the central stem breaks into limbs.

Growth and Mortality

Net volume growth of growing stock.—Net annual growth of growing stock is the change in volume of sound wood that occurred during 1976 in growing-stock trees that were 5.0 inches d.b.h. or larger at the beginning of the year,

plus

the volume of sound wood in growing-stock trees smaller than 5.0 inches d.b.h. at the beginning of the year that grew sufficiently during the year to be reclassified into the 5.0-inch-or-larger d.b.h. classes (ingrowth),

plus

the volume of sound wood in trees that had been classified either as rough or rotten trees at the beginning of the year but were reclassified during the year as growing-stock trees,

plus

the annual change in volume of sound wood that occurred during the year on growing-stock trees that died during the year,

plus

the annual change in volume of sound wood that occurred in growing-stock trees included among timber removals for the year,

plus

the annual change in volume of sound wood in trees that had been classified as growing stock at the beginning of the year but were reclassified during the year as rotten or rough trees. Only the volume change that occurred during the portion of the year the trees were classified as growing stock was included,

minus

the volume of sound wood in growing-stock trees that died from natural causes during the year,

minus

the volume of sound wood in trees that had been classified as growing stock at the beginning of the year, but were reclassified during the year as rough or rotten trees.

Net annual growth of sawtimber.—Net annual growth of sawtimber is the change in volume of sound wood that occurred during 1976 in trees that were sawtimber size at the beginning of the year,

plus

the volume of sound wood in growing-stock trees smaller than sawtimber size at the beginning of the year that grew sufficiently during the year to be classified as sawtimber trees (ingrowth),

plus

the volume of sound wood in trees that had been classified either as rough or rotten trees at the beginning of the year, but were reclassified during the year as sawtimber trees,

plus

the annual change in volume of sound wood that occurred during the year on sawtimber trees that died during the year,

plus

the annual change in volume of sound wood that occurred in sawtimber trees included among timber removals for the year.

plus

The annual change in volume of sound wood in trees that had been classified as sawtimber trees at the beginning of the year, but were reclassified during the year as rough or rotten trees. Only the volume change that occurred during the portion of the year the trees were classified as sawtimber was included,

minus

the volume of sound wood in trees that had been classified as sawtimber trees that died from natural causes during the year,

minus

the volume of sound wood in trees that had been classified as sawtimber trees at the beginning of the year, but were reclassified during the year as rough or rotten trees.

Mortality of growing stock.—The volume of sound wood in growing-stock trees dying annually from natural causes. Natural causes include fire, insects, disease, animal damage, weather, and suppression.

Mortality of sawtimber.—The net board-foot volume of sawtimber trees dying annually from natural causes.

Timber Removals

Timber removals from growing stock. —The volume of sound wood in growing-stock trees removed annually for forest products (including roundwood products and logging residues) and for other removals. Roundwood products are logs, bolts,

or other round sections cut and used from trees. Logging residues are the unused portions of cut trees plus unused trees killed by logging. Other removals are growing-stock trees removed but not utilized for products or trees left standing but "removed" from the commercial forest land classification by land use change—examples are removals from cultural operations such as timber stand improvement work, land clearing, and changes in land use.

Timber removals from sawtimber.—The net board-foot volume of live sawtimber trees removed for forest products annually (including roundwood products and logging residues) and for other removals.

Timber products output.—All timber products cut from roundwood, and byproducts of wood manufacturing plants. Roundwood products include logs, bolts, or other round sections cut from growing-stock trees, cull trees, salvable dead trees, trees on nonforest land, noncommercial species, sapling-size trees, and limbwood. Byproducts from primary manufacturing plants include slabs, edgings, trimmings, miscuts, sawdust, shavings, veneer cores and clippings, and screenings of pulpmills that are used as pulpwood chips or other products.

Plant byproducts.—Wood products, such as pulpwood chips, obtained incidental to production of other manufactured products.

Plant residues.—Wood materials from manufacturing plants not utilized for some product.

Table 1.—*Area of land by land class, Central Hardwood Unit, Minnesota, 1962 and 1977*
(In thousand acres)

Land class	[1]1962	1977
COMMERCIAL FOREST LAND:		
Jack pine	23.3	11.3
Red pine	14.1	10.6
White pine	6.6	7.0
Balsam fir	7.7	7.5
White spruce	2.9	—
Black spruce	20.7	17.9
Northern white-cedar	—	—
Tamarack	58.5	30.8
Oak-hickory	600.3	571.8
Elm-ash-cottonwood	414.0	129.5
Maple-basswood	327.8	485.8
Aspen	640.0	560.2
Paper birch	15.2	80.1
Balsam poplar	—	10.7
Nonstocked	229.2	27.9
Subtotal	2,360.3	1,951.1
NONCOMMERCIAL FOREST LAND:		
Unproductive	351.3	120.2
Productive-reserved	36.6	72.4
Subtotal	387.9	192.6
NONFOREST LAND:	9,215.3	9,775.5
TOTAL	11,963.5	11,919.2

[1]Figures have been adjusted from those published after the 1962 survey to conform to 1977 areas because of changes in survey procedures and definitions.

Table 2.—*Area of land by land use class and county, Central Hardwood Unit, Minnesota, 1977*

(In thousand acres)

Land class	All counties	Anoka	Benton	Carver	Chisago	Dakota	Douglas	Fillmore	Goodhue	Hennepin	Houston	Isanti	Kanabec	Le Sueur
FOREST LAND:														
Commercial	1,951.1	36.6	26.1	10.4	50.2	16.5	18.5	65.3	56.4	7.8	111.5	46.9	129.0	10.0
Productive-reserved	72.4	1.4	0.3	0.7	1.0	0.9	0.9	2.6	0.9	2.7	1.0	1.9	0.6	0.4
Unproductive	120.2	4.9	1.9	1.2	4.5	2.1	1.0	5.0	3.4	0.9	7.1	5.3	4.9	1.0
Total forest	2,143.7	42.9	28.3	12.3	55.7	19.5	20.4	72.9	60.7	11.4	119.6	54.1	134.5	11.4
NONFOREST LAND:														
Nonforest with trees:														
Cropland with trees	35.4	1.6	0.4	1.9	1.1	—	—	1.1	0.8	2.0	0.9	0.9	0.3	2.9
Improved pasture with trees	50.0	1.4	1.2	1.1	1.1	—	0.3	2.0	1.1	1.0	2.1	1.0	1.4	1.1
Wooded strips	99.4	3.6	2.3	3.6	2.4	0.3	0.2	3.9	2.1	3.5	3.2	2.0	2.0	4.8
Idle farmland with trees	3.9	0.2	0.3	—	0.2	—	0.1	0.1	0.1	—	0.1	0.3	0.1	—
Windbreaks	103.1	5.5	5.4	3.6	2.7	0.6	—	6.1	2.1	3.3	4.1	1.6	1.0	3.3
Wooded pasture	80.5	2.8	1.4	1.8	2.0	0.1	0.9	4.5	1.7	1.7	3.0	2.1	2.0	1.9
Total nonforest with trees	372.3	15.1	11.0	12.0	9.5	1.0	1.5	17.7	7.9	11.5	13.4	7.9	6.8	14.0
Nonforest without trees:														
Cropland without trees	7,218.5	163.1	170.2	159.0	153.2	273.7	306.5	360.5	322.0	259.0	172.6	165.4	139.8	204.2
Improved pasture without trees	159.5	3.6	3.7	0.3	3.4	5.7	6.5	7.7	6.9	5.4	4.2	3.7	3.3	4.3
Idle farmland without trees	5.8	0.1	0.1	—	0.1	0.1	0.1	0.1	0.1	0.1	—	0.1	0.1	—
Marsh	662.5	16.6	14.1	11.9	15.3	19.6	22.9	26.8	23.7	18.5	13.5	17.2	20.4	15.0
Other farm-farmstead	219.0	5.0	5.2	4.8	4.6	8.2	9.2	11.1	9.8	7.8	5.4	5.0	4.2	6.1
Urban and other	1,085.7	23.8	24.6	26.4	25.7	40.6	43.3	53.0	50.6	48.8	32.3	26.1	24.4	25.3
Noncensus water	52.2	0.8	0.2	0.2	0.6	—	3.5	—	0.4	0.6	0.4	1.1	1.6	1.3
Total nonforest without trees	9,403.2	213.0	218.1	205.6	202.9	347.9	392.0	459.2	413.5	340.2	228.4	218.6	193.8	256.2
Total nonforest	9,775.5	228.1	229.1	217.6	212.4	348.9	393.5	476.9	421.4	351.7	241.8	226.5	200.6	270.2
Total land area[1]	11,919.2	271.0	257.4	229.9	268.1	368.4	413.9	549.8	482.1	363.1	361.4	280.6	335.1	281.6
Census water	581.9	12.5	3.1	9.5	16.1	7.9	48.8	—	11.3	26.6	3.1	8.0	4.1	17.3
Total gross area	12,501.1	283.5	260.5	239.4	284.2	376.3	462.7	549.8	493.4	389.7	364.5	288.6	339.2	298.9

[1]U.S. Department of Commerce, Bureau of Census. 1970. Area measurements reports, GE-20, 22 p.

(Table 2 continued on next page)

(Table 2 continued)

Land class	Mille Lacs	Morrison	Olmsted	Otter Tail	Pine	Ramsey	Rice	Scott	Sherburne	Stearns	Todd	Wabasha	Wash-ington	Winona	Wright
FOREST LAND:															
Commercial	122.8	148.7	32.0	186.3	425.6	—	12.1	13.6	56.9	56.0	104.5	57.4	10.2	106.3	33 5
Productive-reserve.	8.7	1.1	0.1	8.6	29.8	0.1	1.2	1.2	0.6	0.1	0.7	0.6	0.9	2 7	0.7
Unproductive	4.7	11.5	3 2	5.6	22.2	—	0.8	1.5	4.8	4.2	5.9	4 1	1.0	5.9	1 6
Total forest	136.2	161.3	35.3	200.5	477.6	0.1	14.1	16.3	62.3	60.3	111.1	62.1	12 1	114 9	35 8
NONFOREST LAND:															
Nonforest with trees:															
Cropland with trees	0.6	2.6	0.4	3.7	0.5	—	3.0	2.0	1.0	4.4	0.7	0.3	0.6	0.6	1.1
Improved pasture with trees	2.2	2.8	0.9	9.9	2.6	—	2.2	0.9	2.7	4.8	1.5	1.0	0.3	2.0	1 4
Wooded strips	3.2	6.1	1.6	13.6	6.7	—	5.5	3.5	3.9	11.4	2.1	1.5	1.0	2.7	2 7
Idle farmland with trees	0.1	0.6	0.1	0.3	0.3	—	—	—	0.3	0.1	0.3	0.1	—	0.2	—
Windbreaks	1.3	5.7	2.6	9.1	3.1	—	4.9	2.8	6.7	16.5	1.3	2.1	0.6	4.0	3.1
Wooded pasture	2.6	7.3	2.1	10.7	4.9	—	3.0	1.7	3.2	7.3	3.5	2.4	0.5	3 0	2 4
Total nonforest with trees	10.0	25.1	7.7	47.3	18.1	—	18.6	10.9	17.8	44.5	9.4	7.4	3.0	12.5	10 7
Nonforest without trees															
Cropland without trees	158.5	412.4	296.5	771.1	261.8	81.3	222.9	151.3	149.8	599.7	370.2	203.1	184 1	207.6	299 0
Improved pasture without trees	3.6	9.2	6.3	16.9	8.0	1.7	4.7	3.2	3.4	12.8	8.4	4 4	3.9	4 9	6 4
Idle farmland without trees	0.1	0.2	0.1	0.4	3.2	—	—	—	0.1	0.1	0.4	0.1	—	—	0.1
Marsh	22.1	40.7	22.1	75.1	63.4	5.6	16.1	11.6	15.5	46.2	40.0	16.3	13.4	15.8	23.1
Other farm-farmstead	4.8	12.7	9.1	23.2	7.8	2.4	6.7	4.6	4.7	18.2	11.2	6.3	5.5	6.4	9 0
Urban and other	28.5	57.7	42.3	98.2	60.8	7.9	33.7	26.5	21.5	74.6	51.7	34 4	22.6	34 8	45 6
Noncensus water	1.8	2.1	0.2	23.5	4.0	—	0.8	1.3	0.7	2.5	0.2	—	2.3	0 2	1 9
Total nonforest without trees	219.4	535.0	376.6	1,008.4	409.0	98.9	284.9	198.5	195.7	754.1	482.1	264.6	231.8	269 7	385 1
Total nonforest	229.4	560.1	384.3	1,055.7	427.1	98.9	303.5	209.4	213.5	798.6	491.5	272.0	234.8	282.2	395.8
Total land area[1]	365.6	721.4	419.6	1,256.2	904.7	99.0	317.6	225.7	275.8	858.9	602.6	334.1	246.9	397.1	431 6
Census water	66.4	19.1	0.2	160.4	8.6	10.4	9.4	7.3	10.3	33.3	24.6	8.3	21.2	7.4	26.7
Total gross area	432.0	740.5	419.8	1,416.6	913.3	109.4	327.0	233.0	286.1	892.2	627.2	342.4	268.1	404.5	458.3

Table 3.— *Area of commercial forest land by county and ownership class, Central Hardwood Unit, Minnesota, 1977*

(In thousand acres)

County	All owners	Ownership class												
		National forest	Bureau of Land Mgmt.	Indian	Misc. federal	State	County & municipal	Forest industry	Farmer	Farmer owned-leased	Misc. priv.-corp.	Misc. priv.-indiv.	Misc. priv.-corp., leased	Misc. priv.-indiv., leased
Anoka	36.6	—	—	—	1.0	3.6	0.5	—	24.7	—	1.2	5.6	—	—
Benton	26.1	—	—	—	0.2	2.7	0.7	—	17.9	—	1.1	3.5	—	—
Carver	10.4	—	—	—	0.6	0.8	0.2	—	6.9	—	0.5	1.4	—	—
Chisago	50.2	—	—	—	1.4	5.3	1.0	—	31.2	—	1.7	9.5	—	0.1
Dakota	16.5	—	—	—	0.6	1.4	0.4	—	10.0	—	0.7	3.4	—	—
Douglas	18.5	—	—	—	—	2.2	0.4	—	11.6	—	0.3	3.9	—	0.1
Fillmore	65.3	—	—	—	0.4	7.6	0.4	—	47.8	—	1.2	7.9	—	—
Goodhue	56.4	—	—	—	1.0	5.4	0.5	—	41.5	—	1.4	6.5	—	0.1
Hennepin	7.8	—	—	—	0.5	0.7	0.2	—	4.7	—	0.4	1.3	—	—
Houston	111.5	—	—	—	1.4	9.0	0.8	—	89.9	—	2.6	7.8	—	—
Isanti	46.9	—	—	—	0.5	5.5	0.7	—	28.8	—	1.3	10.1	—	—
Kanabec	129.0	—	—	0.5	1.3	16.7	5.9	—	64.7	—	4.9	34.9	—	0.1
Le Sueur	10.0	—	—	—	0.8	0.8	0.2	—	5.8	—	0.6	1.8	—	—
Mille Lacs	122.8	—	—	0.5	0.9	15.8	5.4	—	62.7	—	4.3	33.0	—	0.2
Morrison	148.7	—	—	0.1	1.3	17.7	1.9	—	99.9	—	3.5	24.3	—	—
Olmsted	32.0	—	—	—	0.2	3.3	0.2	—	24.0	—	0.6	3.7	—	—
Otter Tail	186.3	—	—	0.8	0.5	24.7	8.2	—	94.1	—	5.8	51.8	—	0.4
Pine	425.6	—	—	2.2	1.6	74.2	25.0	0.5	158.9	—	17.4	145.4	—	0.4
Ramsey	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Rice	12.1	—	—	—	0.9	1.0	0.3	—	7.1	—	0.7	2.1	—	—
Scott	13.6	—	—	—	1.0	1.0	0.2	—	8.7	—	0.7	2.0	—	—
Sherburne	56.9	—	—	—	0.4	6.7	0.4	—	42.1	—	1.0	6.3	—	—
Stearns	56.0	—	—	—	0.6	4.3	0.8	—	43.6	—	1.8	4.9	—	—
Todd	104.5	—	—	0.3	0.7	13.2	2.6	—	61.6	—	2.5	23.4	—	0.2
Wabasha	57.4	—	—	—	0.5	6.5	0.5	—	41.5	—	1.2	7.2	—	—
Washington	10.2	—	—	—	0.7	1.0	0.3	—	5.5	—	0.6	2.1	—	—
Winona	106.3	—	—	—	1.0	9.7	0.7	—	84.3	—	2.3	8.3	—	—
Wright	33.5	—	—	—	0.3	3.9	0.6	—	21.9	—	0.8	6.0	—	—
All counties	1,951.1	—	—	4.4	20.3	244.7	59.0	0.5	1,141.4	—	61.1	418.1	—	1.6

Table 4.— *Area of commercial forest land by county and forest type, Central Hardwood Unit, Minnesota, 1977*

(In thousand acres)

County	All types	Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar	Tamarack	Oak-hickory	Elm-ash-cottonwood	Maple-basswood	Aspen	Paper birch	Balsam poplar	Non-stocked
Anoka	36.6	0.3	0.3	0.1	0.1	—	—	—	0.7	11.7	4.0	11.7	5.8	0.9	0.1	0.9
Benton	26.1	0.7	0.7	0.1	—	—	—	—	0.1	9.5	1.7	7.4	4.9	0.7	0.1	0.2
Carver	10.4	—	—	0.1	—	—	—	—	0.1	3.4	1.3	4.0	1.1	0.2	—	0.2
Chisago	50.2	0.8	0.7	0.1	0.1	—	0.5	—	1.4	12.5	5.0	17.3	9.1	1.2	0.3	1.2
Dakota	16.5	—	0.2	—	—	—	—	—	0.5	3.7	2.7	5.3	3.0	0.6	—	0.5
Douglas	18.5	—	—	0.1	—	—	—	—	0.3	4.4	1.3	5.4	5.7	0.6	0.2	0.5
Fillmore	65.3	0.4	0.1	0.2	—	—	—	—	0.2	33.5	3.0	13.7	11.0	2.3	0.3	0.6
Goodhue	56.4	0.3	0.2	0.1	—	—	—	—	0.2	29.5	3.0	13.8	6.6	2.0	0.2	0.5
Hennepin	7.8	—	—	—	—	—	—	—	0.2	1.7	1.1	3.3	1.0	0.1	0.2	0.2
Houston	111.5	0.2	0.1	0.2	—	—	—	—	0.1	66.6	3.9	28.1	8.1	3.3	0.6	0.3
Isanti	46.9	1.3	1.3	0.1	0.1	—	0.8	—	2.0	11.1	4.2	12.7	10.5	1.3	0.3	1.2
Kanabec	129.0	0.1	0.4	0.2	0.2	—	0.9	—	2.9	27.0	9.8	29.4	49.4	6.5	0.5	1.7
Le Sueur	10.0	—	—	—	—	—	—	—	0.3	2.0	1.7	4.2	1.3	0.2	—	0.3
Mille Lacs	122.8	0.1	0.5	0.4	0.2	—	0.8	—	2.6	22.7	9.1	34.2	43.9	5.8	0.6	1.9
Morrison	148.7	1.1	0.9	0.3	—	—	0.4	—	2.4	57.0	9.9	35.9	32.6	5.1	0.8	2.3
Olmsted	32.0	0.1	0.1	0.1	—	—	—	—	0.2	16.1	1.7	7.2	5.1	1.0	0.1	0.3
Otter Tail	186.3	0.5	0.8	1.5	0.4	—	1.4	—	3.5	31.4	12.3	50.0	70.2	9.3	1.6	3.4
Pine	425.6	3.6	2.4	1.5	5.8	—	13.0	—	9.9	37.2	26.6	77.9	214.6	25.1	2.4	5.6
Ramsey	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Rice	12.1	—	—	—	—	—	—	—	0.1	2.3	1.6	5.7	1.8	0.2	0.1	0.3
Scott	13.6	—	—	—	—	—	—	—	0.2	3.9	2.0	5.6	1.4	0.2	—	0.3
Sherburne	56.9	0.9	1.3	1.1	0.3	—	—	—	0.2	28.5	2.8	12.6	6.7	1.7	0.3	0.5
Stearns	56.0	0.1	0.1	0.2	—	—	—	—	0.4	26.6	3.7	16.1	6.8	1.4	0.3	0.3
Todd	104.5	0.1	0.2	0.3	0.3	—	—	—	1.3	23.8	7.5	32.7	31.6	3.4	0.6	2.7
Wabasha	57.4	0.3	0.2	0.1	—	—	—	—	0.4	28.6	2.9	12.8	9.2	2.1	0.2	0.6
Washington	10.2	—	—	—	—	—	0.1	—	0.3	1.5	1.6	4.4	1.7	0.3	—	0.3
Winona	106.3	0.3	0.1	0.1	—	—	—	—	—	63.8	3.2	25.0	9.3	3.5	0.5	0.5
Wright	33.5	0.1	—	0.1	—	—	—	—	0.3	11.8	1.9	9.4	7.8	1.1	0.4	0.6
All counties	1,951.1	11.3	10.6	7.0	7.5	—	17.9	—	30.8	571.8	129.5	485.8	560.2	80.1	10.7	27.9

Table 5.— *Area of commercial forest land by county and site index class, Central Hardwood Unit, Minnesota, 1977*

(In thousand acres)

County	All classes	91+	81-90	71-80	61-70	51-60	41-50	31-40	21-30	11-20
Anoka	36.6	—	0.9	3.8	9.1	10.5	8.4	3.5	0.4	—
Benton	26.1	0.1	0.5	3.4	6.3	7.7	5.5	2.5	0.1	—
Carver	10.4	—	0.5	1.1	2.5	3.0	2.3	1.0	—	—
Chisago	50.2	—	1.4	5.9	11.7	14.9	11.2	4.8	0.3	—
Dakota	16.5	—	0.5	1.5	4.8	4.8	3.7	1.0	0.2	—
Douglas	18.5	—	0.3	1.7	4.7	5.3	4.7	1.7	0.1	—
Fillmore	65.3	0.1	1.5	7.3	15.9	16.1	16.3	7.8	0.3	—
Goodhue	56.4	0.2	1.6	6.2	13.4	15.7	13.5	5.7	0.1	—
Hennepin	7.8	—	0.3	1.1	1.9	2.3	1.6	0.6	—	—
Houston	111.5	0.6	3.0	11.0	25.5	33.3	26.7	11.3	0.1	—
Isanti	46.9	—	1.0	5.2	10.7	13.3	11.4	4.9	0.4	—
Kanabec	129.0	0.1	2.6	16.8	37.3	36.9	25.2	9.6	0.5	—
Le Sueur	10.0	—	0.6	1.1	2.4	3.0	2.1	0.7	0.1	—
Mille Lacs	122.8	—	2.2	15.7	34.6	35.3	25.5	8.9	0.6	—
Morrison	148.7	0.3	3.4	16.1	37.0	39.4	36.3	15.3	0.9	—
Olmsted	32.0	0.1	0.6	3.5	7.8	8.1	8.0	3.8	0.1	—
Otter Tail	186.3	—	2.8	23.3	51.6	54.7	39.4	13.5	1.0	—
Pine	425.6	—	6.2	60.8	126.5	131.9	65.9	30.9	3.4	—
Ramsey	—	—	—	—	—	—	—	—	—	—
Rice	12.1	—	0.6	1.4	2.8	3.8	2.5	1.0	—	—
Scott	13.6	—	0.7	1.5	3.2	4.1	2.9	1.1	0.1	—
Sherburne	56.9	0.2	1.1	6.1	13.6	16.0	14.0	5.7	0.2	—
Stearns	56.0	0.2	1.2	6.3	12.9	16.6	12.5	6.1	0.2	—
Todd	104.5	—	1.9	11.3	27.8	30.6	24.4	7.9	0.6	—
Wabasha	57.4	0.3	1.3	6.3	14.0	14.8	14.1	6.3	0.3	—
Washington	10.2	—	0.4	1.2	2.7	3.2	2.0	0.6	0.1	—
Winona	106.3	0.6	2.8	10.8	24.5	30.7	25.8	11.0	0.1	—
Wright	33.5	—	0.7	3.7	8.3	9.1	8.3	3.3	0.1	—
All counties	1,951.1	2.8	40.6	234.1	513.5	565.1	414.2	170.5	10.3	—

Table 6.— *Area of commercial forest land by county and stand-size class, Central Hardwood Unit, Minnesota, 1977*

(In thousand acres)

County	All stands	Sawtimber stands	Poletimber stands	Sapling and seedling stands	Nonstocked areas
Anoka	36.6	19.5	10.6	5.6	0.9
Benton	26.1	13.1	8.3	4.5	0.2
Carver	10.4	6.6	2.4	1.2	0.2
Chisago	50.2	24.1	17.1	7.9	1.1
Dakota	16.5	7.5	6.7	1.8	0.5
Douglas	18.5	6.5	8.0	3.5	0.5
Fillmore	65.3	35.4	22.5	6.8	0.6
Goodhue	56.4	32.2	18.6	5.1	0.5
Hennepin	7.8	4.6	1.9	0.9	0.4
Houston	111.5	71.7	29.7	9.7	0.4
Isanti	46.9	17.8	18.7	9.2	1.2
Kanabec	129.0	41.2	68.8	17.3	1.7
Le Sueur	10.0	5.8	2.9	1.0	0.3
Mille Lacs	122.8	39.1	64.6	17.2	1.9
Morrison	148.7	68.9	55.9	21.6	2.3
Olmsted	32.0	18.0	10.0	3.7	0.3
Otter Tail	186.3	53.3	101.0	28.6	3.4
Pine	425.6	84.9	246.1	89.0	5.6
Ramsey	—	—	—	—	—
Rice	12.1	7.2	3.3	1.3	0.3
Scott	13.6	8.6	3.2	1.4	0.4
Sherburne	56.9	31.2	17.0	8.4	0.3
Stearns	56.0	33.6	15.5	6.6	0.3
Todd	104.5	37.7	47.1	17.1	2.6
Wabasha	57.4	30.7	19.9	6.0	0.8
Washington	10.2	5.6	3.2	1.2	0.2
Winona	106.3	66.0	30.8	9.1	0.4
Wright	33.5	14.7	14.0	4.2	0.6
All counties	1,951.1	785.5	847.8	289.9	27.9

Table 7.— *Area of commercial forest land by site and ownership class, Central Hardwood Unit, Minnesota, 1977*

(In thousand acres)

Owner	All classes	Site class (cubic feet of growth/acre/year)					
		225+	165-225	120-165	85-120	50-85	20-50
National forest	—	—	—	—	—	—	—
Bureau of Land Mgmt.	—	—	—	—	—	—	—
Indian	4.4	—	—	—	—	2.8	1.6
Miscellaneous federal	20.3	—	—	—	1.4	11.9	7.0
State	244.7	—	—	2.8	34.9	88.6	118.4
County and municipal	59.0	—	—	—	7.1	28.3	23.6
Forest industry	0.5	—	—	—	—	0.5	—
Farmer	1,141.4	—	1.4	1.6	82.9	436.7	618.8
Farmer owned-leased	—	—	—	—	—	—	—
Misc. private-corp.	61.1	—	—	—	9.3	24.5	27.3
Misc. private-individual	418.1	—	—	1.9	47.7	197.4	171.1
Misc. priv.-corp., leased	—	—	—	—	—	—	—
Misc. priv.-ind., leased	1.6	—	—	—	—	—	1.6
All owners	1,951.1	—	1.4	6.3	183.3	790.7	969.4

Table 8.— *Area of commercial forest land by forest type and ownership class, Central Hardwood Unit, Minnesota, 1977*

(In thousand acres)

Owner	All types	Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar	Tamarack	Oak-hickory	Elm-ash-cottonwood	Maple-basswood	Aspen	Paper birch	Balsam poplar	Non-stocked
National forest	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Bureau of Land Mgmt.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Indian	4.4	—	—	—	—	—	—	—	—	1.4	—	3.0	—	—	—	—
Miscellaneous federal	20.3	—	—	—	—	—	—	—	—	2.5	13.5	3.0	1.3	—	—	—
State	244.7	3.2	1.9	—	3.5	—	5.1	—	4.7	46.4	19.1	35.4	113.2	11.7	—	0.5
County and municipal	59.0	—	—	—	—	—	—	—	—	6.4	4.3	16.5	26.4	5.4	—	—
Forest industry	0.5	0.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Farmer	1,141.4	3.6	4.8	5.1	2.3	—	1.7	—	17.7	428.9	54.4	337.9	216.5	36.2	10.7	21.6
Farmer owned-leased	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Misc. private-corp.	61.1	—	0.8	—	—	— 0.8	—	1.4	16.4	5.8	11.2	20.1	3.0	—	1.6	
Misc. private-individual	418.1	4.0	3.1	1.9	1.7	—	10.3	—	7.0	69.8	32.4	77.2	182.7	23.8	—	4.2
Misc. private corp., leased	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Misc. private ind., leased	1.6	—	—	—	—	—	—	—	—	—	—	1.6	—	—	—	—
All owners	1,951.1	11.3	10.6	7.0	7.5	—	17.9	—	30.8	571.8	129.5	485.8	560.2	80.1	10.7	27.9

Table 9.—*Area of commercial forest land by forest type and stand-age class, Central Hardwood Unit, Minnesota, 1977*

(In thousand acres)

Forest type	All ages	Stand-age class (years)												
		1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	140+
Jackpine	11.3	—	—	2.6	3.8	3.2	—	1.7	—	—	—	—	—	—
Red pine	10.6	—	1.9	5.8	—	1.3	—	—	—	1.6	—	—	—	—
White pine	7.0	—	1.9	—	—	—	1.4	3.0	0.7	—	—	—	—	—
Balsam fir	7.5	—	2.0	—	—	4.2	1.3	—	—	—	—	—	—	—
White spruce	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Black spruce	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Tamarack	30.8	—	4.4	2.2	0.8	7.0	4.7	2.8	1.4	2.7	1.6	1.6	1.6	—
Oak-hickory	571.8	9.0	21.4	5.5	34.4	75.5	78.5	100.3	65.0	66.2	68.6	39.8	7.6	—
Elm-ash-cottonwood	129.5	10.1	12.7	7.3	4.7	17.9	23.6	19.5	15.6	4.5	10.6	1.6	1.4	—
Maple-basswood	485.8	18.3	18.3	15.5	39.7	60.8	70.8	91.5	69.7	46.9	24.7	26.5	3.1	—
Aspen	560.2	82.7	48.2	39.1	124.8	146.5	81.7	25.5	7.9	3.8	—	—	—	—
Paper birch	80.1	1.3	6.9	5.4	17.0	20.1	13.6	4.5	5.4	4.5	—	1.4	—	—
Balsam poplar	10.7	1.4	1.4	—	—	3.2	3.2	—	—	1.5	—	—	—	—
Nonstocked	27.9	20.8	2.4	1.6	—	1.7	—	—	1.4	—	—	—	—	—
All types	1,951.1	143.6	123.2	92.9	226.0	343.0	283.1	250.4	167.1	131.7	105.5	70.9	13.7	—

Table 10.— *Area of commercial forest land by forest type, stand-size class, and site class, Central Hardwood Unit, Minnesota, 1977*

(In thousand acres)

Forest type and stand-size class	All site classes	Site class (cubic feet)				
		165 or more	120-165	85-120	50-85	Less than 50
Jack pine						
Sawtimber	3.1	—	—	1.4	1.7	—
Poletimber	6.3	—	—	0.7	2.4	3.2
Sapling & seedling	1.9	—	—	—	—	1.9
All stands	11.3	—	—	2.1	4.1	5.1
Red pine						
Sawtimber	1.6	—	—	—	1.6	—
Poletimber	6.3	—	1.9	3.1	6.3	—
Sapling & seedling	2.7	—	—	0.8	1.9	—
All stands	10.6	—	1.9	3.9	4.8	—
White pine						
Sawtimber	5.1	1.4	1.6	2.1	—	—
Poletimber	—	—	—	—	—	—
Sapling & seedling	1.9	—	—	1.9	—	—
All stands	7.0	1.4	1.6	4.0	—	—
Balsam fir						
Sawtimber	2.3	—	—	2.3	—	—
Poletimber	3.2	—	—	3.2	—	—
Sapling & seedling	2.0	—	—	—	—	2.0
All stands	7.5	—	—	5.5	—	2.0
White spruce						
Sawtimber	—	—	—	—	—	—
Poletimber	—	—	—	—	—	—
Sapling & seedling	—	—	—	—	—	—
All stands	—	—	—	—	—	—
Black spruce						
Sawtimber	—	—	—	—	—	—
Poletimber	5.1	—	—	—	—	5.1
Sapling & seedling	12.8	—	—	—	—	12.8
All stands	17.9	—	—	—	—	17.9
Northern white-cedar						
Sawtimber	—	—	—	—	—	—
Poletimber	—	—	—	—	—	—
Sapling & seedling	—	—	—	—	—	—
All stands	—	—	—	—	—	—

(Table 10 continued on next page)

(Table 10 continued)

Forest type and stand-size class	All site classes	Site class (cubic feet)				
		165 or more	120-165	85-120	50-85	Less than 50
Tamarack						
Sawtimber	7.6	—	—	—	3.1	4.5
Poletimber	14.5	—	—	2.0	1.5	11.0
Sapling & seedling	8.7	—	—	—	2.8	5.9
All stands	30.8	—	—	2.0	7.4	21.4
Oak-hickory						
Sawtimber	343.2	—	2.8	7.2	112.6	220.6
Poletimber	194.0	—	—	7.8	69.3	116.9
Sapling & seedling	34.6	—	—	—	10.1	24.5
All stands	571.8	—	2.8	15.0	192.0	362.0
Elm-ash-cottonwood						
Sawtimber	39.1	—	—	4.8	17.0	17.3
Poletimber	62.7	—	—	—	7.4	55.3
Sapling & seedling	27.7	—	—	—	3.2	24.5
All stands	129.5	—	—	4.8	27.6	97.1
Maple-basswood						
Sawtimber	296.7	—	—	17.9	115.1	163.7
Poletimber	147.4	—	—	7.6	42.3	97.5
Sapling & seedling	41.7	—	—	—	9.6	32.1
All stands	485.8	—	—	25.5	167.0	293.3
Aspen						
Sawtimber	70.1	—	—	13.1	49.7	7.3
Poletimber	349.1	—	—	80.9	219.9	48.3
Sapling & seedling	141.0	—	—	25.0	82.4	33.6
All stands	560.2	—	—	119.0	352.0	89.2
Paper birch						
Sawtimber	16.7	—	—	—	3.9	12.8
Poletimber	51.1	—	—	—	22.4	28.7
Sapling & seedling	12.3	—	—	—	12.3	
All stands	80.1	—	—	—	26.3	53.8
Balsam poplar						
Sawtimber	—	—	—	—	—	—
Poletimber	8.1	—	—	1.5	3.4	3.2
Sapling & seedling	2.6	—	—	—	1.3	1.3
All stands	10.7	—	—	1.5	4.7	4.5
Nonstocked	27.9	—	—	—	4.8	23.1
All types	1,951.1	1.4	6.3	183.3	790.7	969.4

Table 11.— *Area of noncommercial forest land by ownership class, Central Hardwood Unit, Minnesota, 1977*

(In thousand acres)

Ownership class	All areas	Productive-reserved areas	Unproductive areas
National Forest	—	—	—
Other federal	3.0	0.1	2.9
State, county and municipal	90.0	67.2	22.8
Forest industry	—	—	—
Farmer	78.8	—	78.8
Miscellaneous private	20.8	5.1	15.7
All ownerships	192.6	72.4	120.2

Table 12.— *Area of noncommercial forest land by forest type, Central Hardwood Unit, Minnesota, 1977*

(In thousand acres)

Forest type	All areas	Productive-reserved areas	Unproductive areas
Jack pine	3.5	3.5	—
Red-white pine	7.7	6.0	1.7
Spruce-fir	4.2	0.5	3.7
Black spruce	6.6	—	6.6
Northern white-cedar	—	—	—
Tamarack	3.0	—	3.0
Oak-hickory	81.6	8 .6	73.0
Elm-ash-cottonwood	41.9	22.1	19.8
Maple-basswood	8.0	8.0	—
Aspen-birch	36.1	23.7	12.4
Nonstocked	—	—	—
All forest types	192.6	72.4	120.2

Table 13.— *Number of all live trees on commercial forest land by species and diameter class, Central Hardwood Unit, Minnesota, 1977*

(In thousand trees)

Species	All classes	Diameter class (inches at breast height) 1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS:															
White pine	4,037	2,531	601	205	202	145	75	74	92	43	37	15	15	2	—
Red pine	8,601	2,513	3,162	2,245	348	110	54	54	45	31	23	11	5	—	—
Jack pine	5,861	1,058	2,555	1,076	651	401	84	24	12	—	—	—	—	—	—
White spruce	807	546	50	101	34	32	19	3	15	—	2	1	4	—	—
Black spruce	10,814	5,211	3,734	1,596	245	12	—	16	—	—	—	—	—	—	—
Balsam fir	6,932	2,753	2,443	1,012	534	122	60	6	—	2	—	—	—	—	—
Tamarack	11,533	3,033	2,922	2,738	1,907	615	199	89	25	3	2	—	—	—	—
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other softwoods	5,629	3,011	1,449	686	341	65	50	11	8	4	3	1	—	—	—
Total	54,214	20,656	16,916	9,659	4,262	1,502	541	277	197	83	67	28	24	2	—
HARDWOODS:															
Select white oaks	51,597	13,826	10,258	8,185	6,576	4,907	3,131	1,982	1,308	592	362	196	238	34	2
Select red oaks	46,569	6,418	5,555	8,085	7,712	6,359	4,516	3,167	2,065	1,259	652	375	353	51	2
Other red oaks	758	—	—	120	116	91	85	108	89	58	41	24	25	1	—
Hickory	14,559	9,663	1,967	1,534	594	404	203	125	48	12	7	2	—	—	—
Yellow birch	1,218	884	200	43	17	19	29	19	—	4	3	—	—	—	—
Hard maple	48,775	29,598	8,909	4,241	2,077	1,544	1,012	587	341	239	117	42	64	3	1
Soft maple	54,607	29,106	16,355	5,368	2,047	678	360	255	177	102	52	31	49	20	7
Ash	62,178	28,741	13,225	9,854	5,658	2,485	1,192	578	247	115	39	21	15	6	2
Balsam poplar	5,070	1,605	928	976	842	468	157	41	27	12	12	—	2	—	—
Paper birch	66,911	24,232	19,068	12,738	7,289	2,559	695	194	114	20	—	2	—	—	—
Bigtooth aspen	7,186	1,467	902	1,419	1,554	985	547	193	72	38	5	4	—	—	—
Quaking aspen	156,878	66,127	34,673	23,414	16,488	9,413	4,479	1,563	532	129	53	2	5	—	—
Basswood	59,893	30,148	11,923	6,458	4,213	2,497	1,883	1,142	707	387	251	122	138	22	2
Elm	77,742	37,835	16,510	8,620	5,537	3,276	2,093	1,226	960	652	344	247	341	86	15
Select hardwoods	15,263	9,275	2,136	1,698	676	590	425	212	157	59	18	4	8	5	—
Other hardwoods	22,461	11,730	4,418	2,449	1,442	987	639	273	222	116	55	48	44	29	9
Noncommercial species	69,600	50,590	14,615	3,224	873	169	66	40	14	3	3	—	1	2	—
Total	761,265	351,245	161,642	98,426	63,711	37,431	21,512	11,705	7,080	3,797	2,014	1,120	1,283	259	40
All species	815,479	371,901	178,558	108,085	67,973	38,933	22,053	11,982	7,277	3,880	2,081	1,148	1,307	261	40

Table 14.— *Number of growing-stock trees on commercial forest land by species and diameter class, Central Hardwood Unit, Minnesota, 1977*

(In thousand trees)

Species	All classes	Diameter class (inches at breast height) 1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS:															
White pine	2,329	1,157	444	162	125	132	69	69	84	40	37	15	15	—	—
Red pine	8,123	2,237	3,004	2,245	326	100	54	50	45	28	23	7	4	—	—
Jack pine	4,972	549	2,380	933	623	388	77	15	7	—	—	—	—	—	—
White spruce	798	547	50	101	34	22	19	3	15	—	2	1	4	—	—
Black spruce	8,811	3,731	3,328	1,505	231	—	—	16	—	—	—	—	—	—	—
Balsam fir	5,269	1,755	1,872	977	506	97	60	2	—	—	—	—	—	—	—
Tamarack	10,065	2,248	2,767	2,456	1,746	587	162	78	21	—	—	—	—	—	—
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other softwoods	4,484	2,697	851	517	321	48	42	4	4	—	—	—	—	—	—
Total	44,851	14,901	14,696	8,896	3,912	1,374	483	237	176	68	62	23	23	—	—
HARDWOODS:															
Select white oaks	36,550	7,815	6,953	6,326	5,334	4,214	2,382	1,655	939	409	252	124	128	17	2
Select red oaks	39,823	5,132	4,543	6,932	6,859	5,676	3,980	2,806	1,743	1,057	512	307	244	31	1
Other red oaks	638	—	—	90	99	80	80	81	90	52	26	15	24	1	—
Hickory	12,111	7,906	1,533	1,379	561	387	189	101	36	12	5	2	—	—	—
Yellow birch	1,097	886	200	—	—	—	11	—	—	—	—	—	—	—	—
Hard maple	36,150	20,727	7,662	3,328	1,576	1,137	730	430	246	179	71	26	37	—	1
Soft maple	40,251	20,301	12,675	4,465	1,581	462	265	188	127	74	30	22	41	15	5
Ash	50,525	21,574	11,422	8,574	4,920	2,179	981	496	210	101	29	18	15	4	2
Balsam poplar	3,916	1,447	480	705	668	416	128	27	24	9	12	—	—	—	—
Paper birch	53,304	16,565	15,629	11,463	6,584	2,290	557	124	80	10	—	2	—	—	—
Bigtooth aspen	5,692	1,033	741	988	1,437	857	442	123	42	22	3	4	—	—	—
Quaking aspen	110,801	46,589	22,304	17,213	12,838	7,190	3,341	979	272	48	21	2	4	—	—
Basswood	44,692	20,250	8,901	5,634	3,693	2,275	1,614	947	617	339	220	95	92	14	1
Elm	58,588	27,129	11,978	7,329	4,626	2,809	1,696	961	764	516	267	189	254	60	10
Select hardwoods	10,271	6,474	1,315	1,150	405	401	251	110	116	36	8	2	3	—	—
Other hardwoods	13,667	7,104	2,804	1,667	777	577	287	120	140	78	33	27	23	21	9
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	518,076	210,932	109,140	77,243	51,958	30,950	16,934	9,148	5,446	2,942	1,489	835	865	163	31
All species	562,927	225,833	123,836	86,139	55,870	32,324	17,417	9,385	5,622	3,010	1,551	858	888	163	31

Table 15.—*Number of short-log trees on commercial forest land by species and diameter class, Central Hardwood Unit, Minnesota, 1977*

(In thousand trees)

Species	All classes	Diameter class (inches at breast height)									
		9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS:											
White pine	1	—	—	—	—	—	—	—	—	1	—
Red pine	9	9	—	—	—	—	—	—	—	—	—
Jack pine	21	14	7	—	—	—	—	—	—	—	—
White spruce	—	—	—	—	—	—	—	—	—	—	—
Black spruce	—	—	—	—	—	—	—	—	—	—	—
Balsam fir	12	12	—	—	—	—	—	—	—	—	—
Tamarack	7	—	7	—	—	—	—	—	—	—	—
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—
Other softwoods	17	17	—	—	—	—	—	—	—	—	—
Total	67	52	14	—	—	—	—	—	—	1	—
HARDWOODS:											
Select white oaks	709	—	326	92	138	66	34	26	21	6	—
Select red oaks	479	—	134	140	75	59	23	27	19	2	—
Other red oaks	25	—	5	12	—	3	3	2	—	—	—
Hickory	17	—	5	10	—	—	2	—	—	—	—
Yellow birch	—	—	—	—	—	—	—	—	—	—	—
Hard maple	169	—	51	47	30	15	19	—	6	1	—
Soft maple	25	—	—	11	8	4	—	—	—	1	1
Ash	79	—	45	21	8	3	2	—	—	—	—
Balsam poplar	—	—	—	—	—	—	—	—	—	—	—
Paper birch	58	—	27	23	8	—	—	—	—	—	—
Bigtooth aspen	27	—	17	7	—	3	—	—	—	—	—
Quaking aspen	221	—	135	48	33	3	—	—	2	—	—
Basswood	186	—	92	42	18	3	4	2	23	2	—
Elm	447	—	169	99	62	46	32	15	16	6	2
Select hardwoods	49	—	7	5	24	10	—	2	1	—	—
Other hardwoods	123	—	73	23	11	7	2	2	4	1	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—
Total	2,614	—	1,086	580	415	222	121	76	92	19	3
All species	2,681	52	1,100	580	415	222	121	76	92	20	3

Table 16.— *Net volume of growing stock and sawtimber on commercial forest land by species, Central Hardwood Unit, Minnesota, 1962 and 1977*

Species	Growing stock		Sawtimber	
	1962[1]	1977	1962[1]	1977
	Thousand cubic feet		*Thousand board feet*[2]	
SOFTWOODS:				
White pine	9,429	12,741	44,248	63,081
Red pine	5,043	13,843	23,723	42,516
Jack pine	8,900	10,151	17,026	23,144
Spruce	3,438	5,260	3,592	8,819
Balsam fir	4,024	5,913	4,162	8,944
Tamarack	25,637	24,900	23,853	48,280
Northern white-cedar	—	—	—	—
Other softwoods	—	3,261	—	4,605
Total	56,471	76,069	116,604	199,389
HARDWOODS:				
White oak	143,625	172,960	421,123	570,892
Red oak	269,754	337,603	639,317	1,290,517
Yellow birch	585	198	2,686	969
Hard maple	30,009	54,508	101,361	198,945
Soft maple	30,906	40,258	76,223	158,377
Ash	73,772	76,509	131,233	227,791
Paper birch	69,330	111,395	40,440	69,492
Aspen	213,803	284,497	169,161	445,383
Basswood	76,438	133,839	228,993	489,971
Elm	141,762	185,338	521,812	691,004
Other hardwoods	77,612	73,642	118,762	211,025
Total	1,127,596	1,470,747	2,451,111	4,354,366
All species	1,184,067	1,546,816	2,567,715	4,553,755

[1]Figures have been adjusted from those published after the 1962 survey to conform to 1977 volumes because of changes in survey definitions and procedures.
[2]International ¼-inch rule.

Table 17.— *Cubic foot volume in all live trees on commercial forest land by species and diameter class, Central Hardwood Unit, Minnesota, 1977*

(In thousand cubic feet)

Species	All classes	Diameter class (inches at breast height) 5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS:													
White pine	13,355	310	692	1,438	955	1,467	2,529	1,720	1,799	991	1,244	210	—
Red pine	14,095	5,633	1,441	845	692	1,126	1,293	1,183	1,075	513	294	—	—
Jack pine	10,678	2,332	3,082	3,766	1,059	274	165	—	—	—	—	—	—
White spruce	1,741	245	135	232	262	68	400	—	88	41	270	—	—
Black spruce	3,699	2,401	944	71	—	283	—	—	—	—	—	—	—
Balsam fir	6,218	2,137	2,198	928	779	145	—	31	—	—	—	—	—
Tamarack	26,048	6,317	9,541	5,062	2,605	1,711	678	73	61	—	—	—	—
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	
Other softwoods	3,892	1,268	1,213	433	529	96	128	63	88	74	—	—	—
Total	79,726	20,643	19,246	12,775	6,881	5,170	5,193	3,070	3,111	1,619	1,808	210	—
HARDWOODS:													
Select white oaks	207,233	15,623	25,015	32,366	31,651	28,520	24,849	14,621	11,418	7,619	12,326	2,835	390
Select red oaks	356,503	17,793	35,586	50,123	52,865	53,129	45,775	36,496	22,928	17,224	20,144	4,205	235
Other red oaks	12,261	136	440	759	1,174	1,573	2,313	1,787	1,357	1,037	1,618	67	—
Hickory	16,278	3,164	2,838	3,488	2,648	2,307	1,028	383	299	123	—	—	—
Yellow birch	556	50	5	49	226	103	—	95	28	—	—	—	—
Hard maple	65,598	7,779	7,473	9,517	10,103	8,343	6,366	6,793	4,137	1,556	3,273	193	65
Soft maple	44,177	9,306	7,165	4,349	3,638	3,747	3,416	2,622	1,412	1,290	3,021	2,349	1,862
Ash	85,096	17,420	20,827	15,605	11,310	8,692	4,946	2,613	1,227	828	960	374	294
Balsam poplar	14,772	2,241	3,938	4,168	2,002	688	754	429	516	—	36	—	—
Paper birch	119,506	37,365	41,216	24,274	9,720	3,480	2,834	480	—	137	—	—	—
Bigtooth aspen	34,964	3,494	8,426	8,716	7,446	3,548	1,665	1,288	189	192	—	—	—
Quaking aspen	309,375	53,736	80,880	78,685	54,340	25,700	10,732	3,100	1,669	162	371	—	—
Basswood	147,627	13,550	18,919	18,999	22,971	19,559	16,896	11,584	9,596	5,487	7,544	2,192	330
Elm	207,172	17,327	22,757	26,784	22,902	19,424	20,836	17,947	12,562	10,853	21,430	10,228	4,122
Select hardwoods	17,607	2,788	1,838	3,009	3,207	2,114	2,331	1,102	378	137	391	312	—
Other hardwoods	37,749	3,727	4,096	4,457	4,581	3,031	3,618	2,931	1,519	1,715	2,494	3,300	2,280
Noncommercial species	10,797	4,779	3,106	1,053	691	557	252	135	62	—	65	97	—
Total	1,687,271	210,278	284,525	286,401	241,475	184,515	148,611	104,406	69,297	48,360	73,673	26,152	9,578
All species	1,766,997	230,921	303,771	299,176	248,356	189,685	153,804	107,476	72,408	49,979	75,481	26,362	9,578

Table 18.—*Net volume of timber on commercial forest land by class of timber and softwoods and hardwoods, Central Hardwood Unit, Minnesota, 1977*

(In thousand cubic feet)

Class of timber	All species	Soft-woods	Hard-woods
GROWING STOCK TREES			
Saw log trees:			
Saw log portion	591,849	26,381	565,468
Upper-stem Portion	220,839	11,149	209,690
Total sawtimber	812,688	37,530	775,158
Poletimber trees	734,128	38,539	695,589
Total growing stock	1,546,816	76,069	1,470,747
CULL TREES			
Rough and rotten cull trees:			
Sawtimber	93,272	1,801	91,471
Poletimber	86,965	1,350	85,615
Total rough and rotten cull	180,237	3,151	177,086
Short log cull trees:			
Sawtimber	39,944	506	39,438
Poletimber	—	—	—
Total short log	39,944	506	39,438
Total cull	220,181	3,657	216,524
Salvable dead trees	12,924	922	12,002
All classes	1,779,921	80,648	1,699,273

Table 19.— *Net volume of growing stock on commercial forest land by species and county, Central Hardwood Unit, Minnesota, 1977*

(In thousand cubic feet)

Species	All counties	Anoka	Benton	Carver	Chisago	Dakota	Douglas	Fillmore	Goodhue	Hennepin	Houston	Isanti	Kanabec	Le Sueur
SOFTWOODS:														
White pine	12,741	133	212	36	222	38	110	340	161	17	219	192	860	11
Red pine	13,843	447	634	61	810	184	41	407	397	47	355	1,262	695	60
Jack pine	10,151	241	425	14	479	63	84	472	247	12	227	797	302	18
White spruce	1,705	6	22	1	50	6	20	—	2	1	7	43	96	2
Black spruce	3,555	21	3	3	87	25	7	1	9	5	4	140	201	8
Balsam fir	5,913	25	36	5	101	34	38	18	29	6	21	100	381	10
Tamarack	24,900	693	127	143	1,286	570	284	162	258	160	114	1,620	2,038	259
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other softwoods	3,261	54	18	11	78	36	37	192	139	8	159	93	166	11
Total	76,069	1,620	1,477	274	3,113	956	621	1,592	1,242	256	1,106	4,247	4,739	379
HARDWOODS:														
Select white oak	172,960	3,849	2,969	1,117	4,487	1,411	1,501	8,986	7,425	686	15,911	3,777	9,061	803
Select red oak	326,516	5,664	4,936	1,663	6,576	2,134	2,039	16,988	16,640	845	37,486	5,809	17,321	1,131
Other red oaks	11,087	190	314	58	173	37	48	660	690	16	1,904	148	346	21
Hickory	15,522	290	367	109	293	56	47	940	1,046	41	2,699	207	515	63
Yellow birch	198	—	2	—	—	—	—	—	—	—	—	—	24	—
Hard maple	54,508	922	793	453	1,622	421	471	1,171	1,635	319	3,484	988	3,507	528
Soft maple	40,258	1,421	463	718	2,006	864	252	678	1,241	604	1,812	970	2,781	942
Ash	76,509	1,852	720	564	2,613	1,555	789	1,553	1,762	544	2,362	2,200	6,124	827
Balsam poplar	12,839	157	116	31	231	67	173	438	283	21	665	282	845	31
Paper birch	111,395	1,092	1,345	269	1,733	548	800	3,055	2,724	170	5,241	1,657	8,880	237
Bigtooth aspen	30,271	246	427	68	538	92	262	713	644	44	1,264	436	2,508	44
Quaking aspen	254,226	1,956	2,331	419	3,422	1,275	1,946	5,236	3,796	350	4,980	3,506	23,712	476
Basswood	133,839	2,800	2,219	1,006	3,946	93	1,185	4,478	4,174	748	8,694	2,616	8,105	858
Elm	185,338	4,741	2,811	1,776	6,444	2,513	1,802	6,314	6,847	1,303	14,114	4,683	10,625	1,943
Select hardwoods	14,303	261	255	75	267	109	80	807	876	29	2,239	242	576	45
Other hardwoods	30,978	1,353	530	621	1,853	405	265	1,223	1,340	479	2,658	1,029	1,391	702
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	1,470,747	26,794	20,598	8,947	36,204	12,425	11,660	53,240	51,123	6,199	105,513	28,550	96,321	8,651
All species	1,546,816	28,414	22,075	9,221	39,317	13,381	12,281	54,832	52,365	6,455	106,619	32,797	101,060	9,030

(Table 19 continued on next page)

(Table 19 continued)

Species	Mille Lacs	Morrison	Olmsted	Otter Tail	Pine	Ramsey	Rice	Scott	Sherburne	Stearns	Todd	Wabasha	Washington	Winona	Wright
SOFTWOODS:															
White pine	778	717	185	1,830	4,911	—	42	33	186	358	510	224	19	229	168
Red pine	545	1,215	220	694	3,425	—	31	70	799	216	336	340	62	368	122
Jack pine	219	1,095	191	667	2,699	—	10	20	601	149	308	336	15	311	149
White spruce	98	34	—	204	923	—	15	4	4	25	111	2	2	1	26
Black spruce	187	96	1	283	2,286	—	4	5	90	5	51	6	19	1	7
Balsam fir	389	141	7	730	3,225	—	14	7	174	47	259	23	19	22	52
Tamarack	1,985	2,025	140	2,601	7,399	—	136	222	151	283	1,262	342	328	32	280
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other softwoods	194	347	81	373	175—	12	12	392	66	154	164	8	199	82	
Total	4,395	5,670	825	7,382	25,043	—	264	373	2,397	1,149	2,991	1,437	472	1,163	886
HARDWOODS:															
Select white oak	8,409	16,555	4,476	11,528	17,579	—	979	1,348	7,276	7,700	8,215	7,552	716	15,159	3,485
Select red oak	14,762	29,096	7,843	20,675	31,229	—	1,159	1,970	15,514	13,568	13,275	15,129	835	35,918	6,311
Other red oaks	191	1,038	316	242	164	—	15	64	704	904	232	613	2	1,782	215
Hickory	265	1,417	442	296	144	—	65	132	1,021	1,075	287	867	31	2,516	291
Yellow birch	16	2	—	26	124	—	—	—	—	—	3	—	1	—	—
Hard maple	4,366	3,001	545	6,695	9,830	—	736	692	1,311	1,555	3,835	1,100	453	3,043	1,032
Soft maple	2,638	2,260	321	3,252	7,569	—	1,098	1,116	662	956	2,060	736	920	1,368	550
Ash	6,207	5,378	770	8,490	16,758	—	789	847	1,167	1,559	5,205	1,627	845	2,128	1,274
Balsam poplar	809	983	193	1,432	3,404	—	42	43	281	285	754	350	30	653	240
Paper birch	8,239	6,609	1,370	13,047	33,398	—	321	328	2,367	2,661	5,306	2,733	281	5,270	1,714
Bigtooth aspen	2,397	1,706	328	3,707	8,928	—	116	76	582	818	1,893	615	56	1,251	512
Quaking aspen	20,579	13,097	2,244	31,996	98,872	—	704	513	2,961	3,468	12,165	4,434	723	5,664	3,401
Basswood	9,505	9,637	2,370	14,118	21,472	—	1,293	1,300	3,969	4,781	8,339	3,869	897	7,975	2,547
Elm	11,252	14,535	3,219	15,753	22,414	—	2,305	2,519	5,988	6,720	11,093	5,736	1,768	12,588	3,532
Select hardwoods	401	1,333	380	485	576	—	27	87	864	767	429	736	23	2,076	258
Other hardwoods	1,101	2,850	624	1,110	1,666	—	865	932	1,023	1,215	1,178	1,127	673	2,240	525
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	91,137	109,497	25,441	132,852	274,127	—	10,514	11,967	45,690	48,032	74,269	47,224	8,254	99,631	25,887
All species	95,532	115,167	26,266	140,234	299,170	—	10,778	12,340	48,087	49,181	77,260	48,661	8,726	100,794	26,773

Table 20.— *Net volume of sawtimber on commercial forest land by species and county, Central Hardwood Unit, Minnesota, 1977*

(In thousand board feet)[1]

Species	All counties	Anoka	Benton	Carver	Chisago	Dakota	Douglas	Fillmore	Goodhue	Hennepin	Houston	Isanti	Kanabec	Le Sueur
SOFTWOODS:														
White pine	63,081	646	1,087	176	1,125	163	575	1,767	818	80	1,111	930	4,240	46
Red pine	42,516	1,303	466	339	1,070	834	175	2,056	1,484	241	1,840	1,049	3,240	283
Jack pine	23,144	532	803	33	939	128	240	1,390	600	25	609	1,616	575	36
White spruce	7,172	16	113	3	235	—	93	—	3	—	32	186	354	—
Black spruce	1,647	68	—	13	63	114	6	5	40	21	15	64	129	35
Balsam fir	8,944	13	27	3	113	5	69	68	51	1	64	160	591	1
Tamarack	48,280	1,501	356	312	2,655	1,033	663	416	523	329	260	3,522	4,634	527
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other softwoods	4,605	64	26	14	145	27	99	280	200	6	233	181	264	10
Total	199,389	4,143	2,878	893	6,345	2,304	1,920	5,982	3,719	703	4,164	7,708	14,027	938
HARDWOODS:														
Select white oak	570,892	14,174	10,835	4,286	15,986	4,629	4,798	32,281	25,617	2,629	55,055	12,542	27,571	2,923
Select red oak	1,237,647	23,700	20,935	7,353	26,337	8,686	7,701	65,367	67,321	3,649	162,332	21,941	56,810	4,884
Other red oaks	52,870	902	1,501	273	835	178	243	3,171	3,323	73	9,264	718	1,580	103
Hickory	31,088	631	776	258	656	99	127	1,843	2,046	115	5,539	407	884	176
Yellow birch	969	1	7	—	1	—	1	—	1	—	2	1	115	—
Hard maple	198,945	4,267	3,501	2,361	7,283	1,731	1,553	5,092	7,417	1,573	15,601	3,832	11,481	2,795
Soft maple	158,377	8,164	1,761	3,952	10,605	5,518	781	2,739	5,900	3,518	7,923	4,854	10,065	5,332
Ash	227,791	6,714	2,266	2,262	9,343	4,978	2,482	5,412	5,626	2,167	6,971	7,112	17,033	3,098
Balsam poplar	18,664	253	201	51	310	121	177	727	602	29	1,413	338	1,200	48
Paper birch	69,492	717	903	199	1,233	217	734	2,471	1,963	98	3,657	1,205	4,477	99
Bigtooth aspen	57,255	469	871	148	1,068	226	415	897	1,155	117	2,623	722	4,573	115
Quaking aspen	388,128	3,136	4,078	698	5,840	2,239	2,679	7,854	6,242	651	7,877	5,252	35,971	863
Basswood	489,971	12,315	8,679	4,614	16,132	3,585	4,491	17,826	16,171	3,484	35,314	9,793	26,315	3,707
Elm	691,004	19,318	11,485	7,618	25,459	9,616	6,278	25,309	26,903	5,569	56,593	16,804	37,196	8,068
Select hardwoods	32,630	581	676	185	542	187	120	1,776	2,221	57	6,282	426	1,015	92
Other hardwoods	128,643	6,180	2,367	3,152	8,681	1,182	923	4,816	5,822	2,438	12,131	3,950	4,883	3,475
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	4,354,365	101,522	70,842	37,410	130,311	43,192	33,503	177,581	178,330	26,167	388,577	89,897	241,169	35,778
All species	4,553,754	105,665	73,720	38,303	136,656	45,496	35,423	183,563	182,049	26,870	392,741	97,605	255,196	36,716

[1]International ¼-inch rule.

(Table 20 continued on next page)

(Table 20 continued)

Species	Mille Lacs	Morrison	Olmsted	Otter Tail	Pine	Ramsey	Rice	Scott	Sherburne	Stearns	Todd	Wabasha	Washington	Winona	Wright
SOFTWOODS:															
White pine	3,826	3,683	941	8,665	24,152	—	211	159	934	1,832	2,609	1,163	82	1,183	877
Red pine	2,398	3,990	1,180	2,849	8,678	—	160	372	1,403	1,155	1,553	1,684	287	1,847	580
Jack pine	299	2,810	564	1,188	5,771	—	20	50	1,574	426	678	960	25	855	398
White spruce	428	126	—	926	3,790	—	72	15	21	128	498	2	2	5	124
Black spruce	121	119	3	54	447	—	9	22	106	20	98	28	36	3	8
Balsam fir	531	251	27	1,104	4,925	—	19	2	138	29	515	57	5	77	98
Tamarack	4,416	4,617	348	5,474	10,075	—	303	479	312	617	2,822	773	552	95	666
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other softwoods	248	548	114	518	318	—	29	12	142	89	333	239	5	299	162
Total	12,267	16,144	3,177	20,778	58,156	—	823	1,111	4,630	4,296	9,106	4,906	994	4,364	2,913
HARDWOODS:															
Select white oak	25,140	57,408	16,447	32,725	44,873	—	3,811	5,157	25,738	28,054	25,317	26,511	2,646	52,114	11,625
Select red oak	48,264	111,121	31,232	65,230	81,417	—	4,983	8,786	65,177	59,098	48,104	58,531	3,452	151,730	23,506
Other red oak	855	4,992	1,505	1,086	396	—	70	306	3,397	4,333	1,126	2,943	9	8,654	1,034
Hickory	423	2,824	866	479	83	—	203	334	2,027	2,247	584	1,685	113	5,091	572
Yellow birch	80	9	—	125	606	—	—	—	—	—	15	—	3	1	1
Hard maple	13,302	11,747	2,302	19,618	27,859	—	3,746	3,690	5,723	6,842	11,686	4,630	2,281	13,332	3,700
Soft maple	9,433	10,315	1,367	8,525	14,757	—	5,879	6,164	2,698	4,168	7,834	3,395	5,313	5,450	1,967
Ash	17,333	17,360	2,716	23,176	42,025	—	3,281	3,375	3,571	5,053	15,532	5,458	3,247	6,184	4,016
Balsam poplar	1,015	1,429	317	1,602	4,449	—	43	67	558	514	860	618	46	1,362	314
Paper birch	5,484	4,908	1,144	9,547	13,908	—	288	211	1,763	1,899	4,921	2,048	68	3,776	1,554
Bigtooth aspen	4,931	2,605	448	7,429	17,219	—	255	177	1,102	1,647	3,739	869	152	2,402	880
Quaking aspen	32,642	19,906	3,333	49,349	144,869	—	1,193	888	4,489	6,393	19,249	6,905	1,222	8,968	5,342
Basswood	32,758	36,663	9,983	48,837	60,411	—	5,825	5,885	16,215	19,442	31,242	15,059	4,032	31,594	9,599
Elm	9,109	55,208	13,172	52,504	71,296	—	9,830	10,762	23,524	27,582	38,955	22,449	7,411	49,941	13,045
Select hardwoods	598	2,801	863	596	436	—	43	214	2,302	2,054	675	1,682	29	5,668	509
Other hardwoods	3,608	10,779	2,476	3,463	5,471	—	4,582	4,746	4,352	5,300	3,992	4,485	3,408	9,929	2,052
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	234,975	350,075	88,171	324,291	530,075	—	44,032	50,762	162,636	174,626	203,831	157,268	33,432	356,196	79,716
All species	247,242	366,219	91,348	345,069	588,231	—	44,855	51,873	167,266	178,922	222,937	162,174	34,426	360,560	82,629

Table 21.— *Net volume of growing stock, sawtimber, short-log, and rough and rotten trees on commercial forest land by individual species, Central Hardwood Unit, Minnesota, 1977*

Species	Total all live	Growing stock	Short-log	Rough and rotten	Sawtimber
	Thousand cubic feet				*Thousand board feet*[1]
SOFTWOODS:					
White pine	13,355	12,741	86	528	63,081
Red pine	14,095	13,843	44	208	42,516
Jack pine	10,678	10,151	164	363	23,144
Scotch pine	1,165	1,036	—	129	1,666
White spruce	1,741	1,705	—	36	7,172
Black spruce	3,699	3,555	—	144	1,647
Balsam fir	6,218	5,913	86	219	8,944
Tamarack	26,048	24,900	39	1,109	48,280
Northern white-cedar	—	—	—	—	—
Eastern redcedar	2,726	2,225	87	415	2,939
Total	79,726	76,069	506	3,151	199,389
HARDWOODS:					
White oak	60,895	49,850	3,520	7,525	190,290
Bur oak	146,214	123,110	6,701	16,403	380,602
Swamp white oak	124	—	—	124	—
Northern red oak	356,503	326,516	8,129	21,858	1,237,647
Black oak	2,734	2,372	—	362	10,525
Northern pin oak	9,527	8,715	385	427	42,345
Bitternut hickory	4,398	4,315	—	83	5,503
Shagbark hickory	11,880	11,207	200	473	25,585
Yellow birch	556	198	—	358	969
Sugar maple	64,857	54,110	3,220	7,527	197,281
Black maple	741	398	—	343	1,664
Red maple	22,913	20,600	—	2,313	34,765
Silver maple	21,264	19,658	559	1,047	123,611
White ash	2,088	1,993	—	95	7,509
Black ash	45,921	41,123	594	4,204	102,160
Green ash	37,087	33,393	543	3,151	118,122
Balsam poplar	14,772	12,839	—	1,933	18,664
Paper birch	119,506	111,395	759	7,352	69,492
Bigtooth aspen	34,964	30,271	471	4,222	57,255
Quakingaspen	309,375	254,226	3,274	51,875	388,128
Basswood	147,627	133,839	3,489	10,299	489,971
American elm	186,655	166,629	5,380	14,646	609,965
Slippery elm	17,777	16,253	418	1,106	70,004
Rock elm	2,740	2,456	104	180	11,035
Butternut	6,136	4,180	354	1,602	10,664
Black walnut	3,906	3,685	124	97	10,801
Black cherry	7,565	6,438	11	1,116	11,165
Boxelder	15,315	10,721	441	4,153	25,622
River birch	504	300	73	131	289
Hackberry	2,453	2,134	242	77	7,937
Eastern cottonwood	10,765	10,028	274	463	55,141
Black willow	8,712	7,795	173	744	39,654
Noncommercial	10,797	—	—	10,797	—
Total	1,687,271	1,470,747	39,438	177,086	4,354,365
All species	1,766,997	1,546,816	39,944	180,237	4,553,754

[1]International ¼-inch rule.

Table 22.— *Net volume of growing stock on commercial forest land by species and diameter class, Central Hardwood Unit, Minnesota, 1977*

(In thousand cubic feet)

Species	All classes	Diameter class (inches at breast height) 5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS:													
White pine	12,741	304	535	1,381	900	1,461	2,479	1,648	1,799	990	1,244	—	—
Red pine	13,843	5,632	1,415	801	692	1,089	1,293	1,133	1,075	468	245	—	—
Jack pine	10,151	2,056	3,036	3,641	1,020	249	149	—	—	—	—	—	—
White spruce	1,705	245	135	196	262	68	400	—	88	41	270	—	—
Black spruce	3,555	2,356	917	—	—	282	—	—	—	—	—	—	—
Balsam fir	5,913	2,129	2,143	828	779	34	—	—	—	—	—	—	—
Tamarack	24,900	6,154	9,188	4,984	2,341	1,602	631	—	—	—	—	—	—
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—
Other softwoods	3,261	1,099	1,195	346	502	49	70	—	—	—	—	—	—
Total	76,069	19,975	18,564	12,177	6,496	4,834	5,022	2,781	2,962	1,499	1,759	—	—
HARDWOODS:													
Select white oaks	172,960	14,093	22,470	29,535	26,607	25,278	19,617	11,255	8,884	5,457	7,773	1,600	390
Select red oaks	326,516	17,118	33,795	47,206	49,287	49,922	41,564	32,736	19,904	15,185	16,466	3,147	187
Other red oaks	11,087	127	420	690	1,131	1,284	2,313	1,648	1,135	678	1,593	68	—
Hickory	15,522	3,062	2,783	3,406	2,537	2,077	918	384	232	123	—	—	—
Yellow birch	198	—	—	—	198	—	—	—	—	—	—	—	—
Hard maple	54,508	7,183	6,575	8,314	8,440	6,988	5,234	5,423	2,815	1,091	2,380	—	65
Soft maple	40,258	8,961	6,777	3,823	3,258	3,583	2,913	2,410	1,164	1,208	2,762	1,886	1,513
Ash	76,509	15,580	18,957	14,375	9,693	7,658	4,432	2,388	1,112	745	961	314	294
Balsam poplar	12,839	1,922	3,438	3,773	1,712	479	666	334	515	—	—	—	—
Paper birch	111,395	35,757	38,920	22,760	8,476	2,693	2,329	323	—	137	—	—	—
Bigtooth aspen	30,271	2,833	7,994	8,021	6,436	2,564	1,172	953	106	192	—	—	—
Quaking aspen	254,226	44,637	68,670	65,570	45,827	19,117	7,218	1,792	961	162	272	—	—
Basswood	133,839	12,470	17,306	17,662	20,255	17,336	15,591	10,952	9,163	4,989	6,147	1,782	186
Elm	185,338	16,629	21,731	23,060	21,373	17,753	19,267	16,591	11,074	9,373	17,808	7,983	2,696
Select hardwoods	14,303	2,335	1,530	2,624	2,660	1,681	2,045	896	287	90	155	—	—
Other hardwoods	30,978	3,243	3,543	3,911	3,510	2,255	3,204	2,381	1,291	1,170	1,749	2,593	2,128
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	1,470,747	185,950	254,909	254,730	211,400	160,668	128,483	90,466	58,643	40,600	58,066	19,373	7,459
All species	1,546,816	205,925	273,473	266,907	217,896	165,502	133,505	93,247	61,605	42,099	59,825	19,373	7,459

Table 23.—*Net volume of sawtimber on commercial forest land by species and diameter class, Central Hardwood Unit, Minnesota, 1977*

(In thousand board feet)[1]

Species	All classes	Diameter class (inches at breast height) 9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS:											
White pine	63,081	7,536	4,364	8,115	12,480	8,924	9,629	5,420	6,613	—	—
Red pine	42,516	6,536	4,575	6,649	7,486	7,009	6,345	2,602	1,314	—	—
Jack pine	23,144	16,711	4,693	1,149	591	—	—	—	—	—	—
White spruce	7,172	1,384	1,643	288	2,058	—	429	185	1,185	—	—
Black spruce	1,647	—	—	1,647	—	—	—	—	—	—	—
Balsam fir-8,944	4,691	4,046	207	—	—	—	—	—	—	—	
Tamarack	48,280	26,451	11,701	7,400	2,728	—	—	—	—	—	—
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—
Other softwoods	4,605	1,941	2,185	204	275	—	—	—	—	—	—
Total	199,389	65,250	33,207	25,659	25,618	15,933	16,403	8,207	9,112	—	—
HARDWOODS:											
Select white oaks	570,892	—	142,321	136,166	107,179	59,429	47,231	28,028	40,076	8,426	2,036
Select red oaks	1,237,647	—	263,736	271,297	229,034	178,267	107,507	81,548	88,873	16,284	1,101
Other red oaks	52,870	—	6,151	6,891	12,124	8,945	6,135	3,669	8,550	405	—
Hickory	31,088	—	12,338	11,226	4,312	1,637	1,051	524	—	—	—
Yellow birch	969	—	969	—	—	—	—	—	—	—	—
Hard maple	198,945	—	51,653	42,240	32,797	33,567	17,982	6,487	13,765	—	454
Soft maple	158,376	—	32,419	30,309	23,475	18,953	9,524	8,650	17,889	10,338	6,819
Ash	227,791	—	91,663	62,138	33,355	18,726	7,657	5,031	5,954	1,762	1,505
Balsam poplar	18,664	—	8,374	2,414	3,599	1,693	2,584	—	—	—	—
Paper birch	69,492	—	41,526	13,191	12,219	1,761	—	795	—	—	—
Bigtooth aspen	57,255	—	32,650	12,381	6,347	4,527	484	866	—	—	—
Quaking aspen	388,128	—	237,184	98,323	37,484	8,635	4,490	761	1,251	—	—
Basswood	489,971	—	114,190	98,792	89,476	62,643	53,411	27,472	33,536	9,553	898
Elm	691,004	—	121,575	101,363	107,495	92,441	61,732	51,212	98,179	42,537	14,470
Select hardwoods	32,630	—	9,737	6,672	8,574	4,226	1,679	640	1,102	—	—
Other hardwoods	128,643	—	26,193	15,771	23,382	16,378	7,832	7,090	9,553	12,597	9,847
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—
Total	4,354,365	—	1,192,679	909,174	730,852	511,828	329,299	222,773	318,728	101,902	37,130
All species	4,553,754	65,250	1,225,885	934,834	756,471	527,760	345,702	230,980	327,840	101,902	37,130

[1]International ¼-inch rule.

Table 24.— *Net volume of growing stock on commercial forest land by species and forest type, Central Hardwood Unit, Minnesota, 1977*

(In thousand cubic feet)

Species	All types	Forest type														
		Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar	Tamarack	Oak-hickory	Elm-ash-cottonwood	Maple-basswood	Aspen	Paper birch	Balsam poplar	Non-stocked
SOFTWOODS:																
White pine	12,741	122	—	5,631	355	—	130	—	111	957	225	2,633	1,489	1,088	—	—
Red pine	13,843	1,390	6,249	895	—	—	—	—	—	1,565	—	—	2,866	878	—	—
Jack pine	10,151	6,629	1,107	—	—	—	—	—	—	62	—	—	2,001	352	—	—
White spruce	1,705	—	—	—	251	—	—	—	53	57	206	287	405	81	365	—
Black spruce	3,555	—	—	—	596	—	1,722	—	399	—	71	75	636	56	—	—
Balsam fir	5,913	89	—	—	1,769	—	295	—	72	—	493	587	1,751	857	—	—
Tamarack	24,900	—	86	—	528	—	1,325	—	17,148	—	1,005	1,970	1,540	853	214	231
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other softwoods	3,261	—	589	—	—	—	—	—	—	1,590	—	879	45	158	—	—
Total	76,069	8,230	8,031	6,526	3,499	—	3,472	—	17,783	4,231	2,000	6,431	10,733	4,323	579	231
HARDWOODS:																
Select white oaks	172,960	31	—	303	—	—	—	—	—	121,445	2,123	30,710	15,603	2,468	151	126
Select red oaks	326,516	—	295	463	—	—	85	—	146	249,221	434	33,920	35,258	6,577	117	—
Other red oaks	11,087	—	—	—	—	—	—	—	—	8,678	317	1,461	497	—	134	—
Hickory	15,522	—	—	—	—	—	—	—	—	12,289	—	2,591	—	642	—	—
Yellow birch	198	—	—	—	—	—	—	—	—	—	198	—	—	—	—	
Hard maple	54,508	—	—	—	—	—	—	—	—	4,025	759	46,208	3,387	129	—	—
Soft maple	40,258	—	—	65	52	—	—	—	80	2,192	17,809	10,443	8,408	1,209	—	—
Ash	76,509	—	—	267	—	—	89	—	23	5,715	27,731	33,549	7,308	1,348	307	172
Balsam poplar	12,839	—	—	—	—	—	—	—	124	678	—	1,387	6,018	346	4,286	—
Paper birch	111,395	149	294	475	126	—	320	—	—	22,391	1,099	15,903	37,537	32,761	170	170
Bigtooth aspen	30,271	—	—	—	—	59	—	—	4,846	—	3,470	20,749	1,147	—	—	
Quaking aspen	254,226	742	695	130	253	—	663	—	296	23,814	1,774	17,603	199,770	7,831	277	378
Basswood	133,839	—	—	—	62	—	—	—	—	17,946	2,092	100,290	12,170	1,279	—	—
Elm	185,338	—	—	—	—	—	—	—	426	30,915	17,353	117,704	13,527	4,287	750	376
Select hardwoods	14,303	—	—	—	—	—	—	—	—	8,287	308	4,100	1,253	230	67	58
Other hardwoods	30,978	—	—	—	—	—	—	—	—	2,989	16,055	10,126	1,465	—	—	343
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	1,470,747	922	1,284	1,703	493	—	1,216	—	1,095	515,431	88,052	429,465	362,950	60,254	6,259	1,623
All species	1,546,816	9,152	9,315	8,229	3,992	—	4,688	—	18,878	519,662	90,052	435,896	373,683	64,577	6,838	1,854

Table 25.— *Net volume of sawtimber on commercial forest land by species and forest type, Central Hardwood Unit, Minnesota, 1977*

(In thousand board feet)[1]

Species	All types	Forest type														
		Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar	Tamarack	Oak-hickory	Elm-ash-cottonwood	Maple-basswood	Aspen	Paper birch	Balsam poplar	Non-stocked
SOFTWOODS:																
White pine	63,081	432	—	26,897	2,006	—	442	—	370	5,592	654	13,744	7,595	5,349	—	—
Red pine	42,516	2,573	7,933	5,669	—	—	—	—	—	7,296	—	—	13,872	5,173	—	—
Jack pine	23,144	16,923	2,819	—	—	—	—	—	—	293	—	—	2,019	1,090	—	—
White spruce	7,172	—	—	—	1,245	—	—	—	—	—	185	1,194	2,330	520	1,698	—
Black spruce	1,647	—	—	—	469	—	—	—	—	—	—	—	1,178	—	—	—
Balsam fir	8,944	221	—	—	3,571	—	—	—	—	—	610	985	3,005	552	—	—
Tamarack	48,280	—	—	—	635	—	1,327	—	32,864	—	2,209	4,987	3,633	1,570	1,055	—
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other softwoods	4,605	—	—	—	—	—	—	—	—	3,054	—	1,551	—	—	—	—
Total	199,389	20,149	10,752	32,566	7,926	—	1,769	—	33,234	16,235	3,658	22,461	33,632	14,254	2,753	—
HARDWOODS:																
Select white oaks	570,892	—	—	552	—	—	—	—	—	397,551	8,498	115,997	36,913	10,298	824	259
Select red oaks	1,237,647	—	—	2,376	—	—	—	—	795	966,136	439	138,283	104,604	24,378	636	—
Other red oaks	52,870	—	—	—	—	—	—	—	—	—	41,247	1,718	7,286	1,894	—	725
Hickory	31,088	—	—	—	—	—	—	—	—	23,196	—	5,034	—	2,858	—	—
Yellow birch	969	—	—	—	—	—	—	—	—	—	969	—	—	—	—	—
Hard maple	198,945	—	—	—	—	—	—	—	—	12,208	2,286	176,692	7,759	—	—	—
Soft maple	158,376	—	—	346	—	—	—	—	—	7,695	109,233	33,482	6,782	838	—	—
Ash	227,791	—	—	368	—	—	—	—	—	3,728	74,324	124,163	11,083	2,336	887	902
Balsam poplar	18,664	—	—	—	—	—	—	—	—	2,362	—	4,193	7,929	415	3,765	—
Paper birch	69,492	—	—	1,090	—	—	—	—	—	16,257	1,188	25,094	15,89	9,965	—	—
Bigtooth aspen	57,255	—	—	—	—	—	—	—	—	11,574	—	11,745	30,386	3,550	—	—
Quaking aspen	388,128	—	1,367	618	—	—	476	—	—	39,515	3,171	42,946	277,917	21,053	600	465
Basswood	489,971	—	—	—	343	—	—	—	—	53,703	7,393	402,765	23,482	2,285	—	—
Elm	691,004	—	—	—	—	—	—	—	—	103,628	58,669	479,180	32,428	12,774	2,877	1,448
Select hardwoods	32,630	—	—	—	—	—	—	—	—	18,453	—	11,990	1,510	677	—	—
Other hardwoods	128,643	—	—	—	—	—	—	—	—	9,499	69,360	43,706	4,153	—	—	1,925
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	4,354,365	—	1,367	5,350	343	—	476	—	795	1,716,752	337,248	1,622,556	562,738	91,427	10,314	4,999
All species	4,553,754	20,149	12,119	37,916	8,269	—	2,245	—	34,029	1,732,987	340,906	1,645,017	596,370	105,681	13,067	4,999

[1]International ¼-inch rule.

Table 26.— *Net volume of growing stock on commercial forest land by species and ownership class, Central Hardwood Unit, Minnesota, 1977*

(In thousand cubic feet)

Species	All owners	Ownership class												
		National forest	Bureau of Land Mgmt.	Indian	Misc. federal	State	County & municipal	Forest industry	Farmer	Farmer owned-leased	Misc. priv.-corp.	Misc. priv.-indiv.	Misc. priv.-corp., leased	Misc. priv.-indiv., leased
SOFTWOODS:														
White pine	12,741	—	—	—	—	995	310	—	10,127	—	114	1,195	—	—
Red pine	13,843	—	—	—	110	2,664	760	—	5,041	—	—	5,268	—	—
Jack pine	10,151	—	—	—	—	1,335	—	297	4,116	—	—	4,403	—	—
White spruce	1,705	—	—	—	—	321	—	—	832	—	—	552	—	—
Black spruce	3,555	—	—	—	—	1,961	—	—	442	—	77	1,075	—	—
Balsam fir	5,913	—	—	—	—	2,104	—	—	1,419	—	—	2,390	—	—
Tamarack	24,900	—	—	—	—	2,488	—	—	14,011	—	383	8,018	—	—
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other softwoods	3,261	—	—	—	—	589	—	—	2,298	—	49	325	—	—
Total	76,069	—	—	—	110	12,457	1,070	297	38,286	—	623	23,226	—	—
HARDWOODS:														
Select white oaks	172,960	—	—	375	90	9,881	1,566	31	132,300	—	3,993	24,596	—	128
Select red oaks	326,516	—	—	749	1,782	34,940	5,804	—	218,131	—	10,908	54,202	—	—
Other red oaks	11,087	—	—	—	380	1,036	—	—	9,294	—	—	377	—	—
Hickory	15,522	—	—	191	327	246	115	—	13,444	—	—	1,199	—	—
Yellow birch	198	—	—	—	—	109	89	—	—	—	—	—	—	—
Hard maple	54,508	—	—	216	195	8,330	2,528	—	35,814	—	444	6,981	—	—
Soft maple	40,258	—	—	225	13,286	3,872	1,001	—	13,557	—	1,069	7,248	—	—
Ash	76,509	—	—	—	3,900	8,959	3,540	—	40,619	—	3,362	16,129	—	—
Balsam poplar	12,839	—	—	—	—	600	81	—	10,177	—	51	1,930	—	—
Paper birch	111,395	—	—	247	241	21,827	3,615	—	49,230	—	5,134	31,101	—	—
Bigtooth aspen	30,271	—	—	245	—	5,912	1,536	—	11,266	—	993	10,319	—	—
Quaking aspen	254,226	—	—	338	394	48,022	14,020	—	98,853	—	16,041	76,558	—	—
Basswood	133,839	—	—	1,660	364	9,265	4,981	—	89,782	—	3,903	23,134	—	750
Elm	185,338	—	—	65	5,421	12,382	2,550	—	134,264	—	3,535	25,601	—	1,520
Select hardwoods	14,303	—	—	—	—	1,506	191	—	10,804	—	485	1,317	—	—
Other hardwoods	30,978	—	—	—	3,749	1,903	—	—	21,465	—	958	2,903	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	1,470,747	—	—	4,311	30,129	168,790	41,617	31	889,000	—	50,876	283,595	—	2,398
All species	1,546,816	—	—	4,311	30,239	181,247	42,687	328	927,286	—	51,499	306,821	—	2,398

Table 27.— *Net volume of sawtimber on commercial forest land by species and ownership class, Central Hardwood Unit, Minnesota, 1977*
(In thousand board feet)[1]

Species	All owners	Ownership class												
		National forest	Bureau of Land Mgmt.	Indian	Misc. federal	State	County & municipal	Forest industry	Farmer	Farmer owned-leased	Misc. priv.-corp.	Misc. priv.-indiv.	Misc. priv.-corp., leased	Misc. priv.-indiv., leased
SOFTWOODS:														
White pine	63,081	—	—	—	—	4,154	1,761	—	50,830	—	610	5,726	—	—
Red pine	42,516	—	—	—	609	9,078	4,452	—	22,475	—	—	5,902	—	—
Jack pine	23,144	—	—	—	—	375	—	156	11,134	—	—	11,479	—	—
White spruce	7,172	—	—	—	—	1,698	—	—	3,718	—	—	1,756	—	—
Black spruce	1,647	—	—	—	—	470	—	—	1,177	—	—	—	—	—
Balsam fir	8,944	—	—	—	—	1,050	—	—	4,109	—	—	3,785	—	—
Tamarack	48,280	—	—	—	—	7,128	—	—	28,448	—	442	12,262	—	—
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other softwoods	4,605	—	—	—	—	—	—	—	2,939	—	204	1,462	—	—
Total	199,389	—	—	—	609	23,953	6,213	156	124,830	—	1,256	42,372	—	—
HARDWOODS:														
Select white oaks	570,892	—	—	—	—	25,571	1,391	—	462,569	—	10,987	69,847	—	527
Select red oaks	1,237,647	—	—	1,363	5,626	111,614	14,225	—	886,300	—	28,439	190,080	—	—
Other red oaks	52,870	—	—	—	2,058	3,007	—	—	46,602	—	—	1,203	—	—
Hickory	31,088	—	—	—	637	285	545	—	28,688	—	—	933	—	—
Yellow birch	969	—	—	—	—	527	442	—	—	—	—	—	—	—
Hard maple	198,945	—	—	591	1,150	20,716	11,976	—	143,719	—	499	20,294	—	—
Soft maple	158,376	—	—	—	80,666	5,577	677	—	55,300	—	1,272	14,884	—	—
Ash	227,791	—	—	—	18,833	20,495	12,678	—	127,518	—	8,080	40,187	—	—
Balsam poplar	18,664	—	—	—	—	480	—	—	15,832	—	—	2,352	—	—
Paper birch	69,492	—	—	—	—	12,949	1,772	—	37,781	—	3,011	13,979	—	—
Bigtooth aspen	57,255	—	—	601	—	11,499	3,808	—	24,630	—	800	15,917	—	—
Quaking aspen	388,128	—	—	982	—	80,040	19,107	—	142,499	—	28,738	116,762	—	—
Basswood	489,971	—	—	2,355	1,202	28,188	7,757	—	363,303	—	11,297	71,918	—	3,951
Elm	691,004	—	—	—	23,195	36,792	6,608	—	512,818	—	11,821	92,481	—	7,289
Select hardwoods	32,630	—	—	—	—	3,129	—	—	26,893	—	802	1,806	—	—
Other hardwoods	128,643	—	—	—	21,089	8,243	—	—	91,159	—	3,026	5,126	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	4,354,365	—	—	5,892	154,456	369,112	80,986	—	2,965,611	—	108,772	657,769	—	11,767
All species	4,553,754	—	—	5,892	155,065	393,065	87,199	156	3,090,441	—	110,028	700,141	—	11,767

[1]International ¼-inch rule.

Table 28.— *Net volume of growing stock on commercial forest land by forest type and stand-age class, Central Hardwood Unit, Minnesota, 1977*

(In thousand cubic feet)

Forest type	All classes	Stand-age class (years)												
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
Jack pine	9,152	—	—	1,070	3,799	2,667	—	1,616	—	—	—	—	—	—
Red pine	9,315	—	3,530	1,720	—	1,471	—	—	—	2,594	—	—	—	—
White pine	8,229	—	—	—	—	—	3,342	3,573	1,314	—	—	—	—	—
Balsam fir	3,992	—	230	—	—	3,426	336	—	—	—	—	—	—	—
White spruce	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Black spruce	4,688	—	72	1,883	107	211	1,719	696	—	—	—	—	—	—
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Tamarack	18,878	—	1,370	348	278	5,389	3,771	1,630	355	1,809	958	1,413	1,557	—
Oak	519,662	1,792	5,925	1,246	31,038	74,696	83,296	99,557	58,395	58,204	62,605	37,641	5,267	—
Elm-ash-cottonwood	90,052	2,621	3,121	2,479	1,928	18,923	19,193	15,943	13,860	2,452	7,267	555	1,710	—
Maple-basswood	435,896	5,303	4,336	7,419	29,079	50,437	72,177	86,746	83,935	42,451	19,610	30,057	4,346	—
Aspen	373,683	17,658	13,962	20,649	96,640	124,004	69,045	20,411	9,522	1,792	—	—	—	—
Paper birch	64,577	264	869	1,928	11,868	21,039	13,981	5,628	4,142	4,593	—	265	—	—
Balsam poplar	6,838	151	365	—	—	2,973	2,520	—	—	829	—	—	—	—
Nonstocked	1,854	1,637	71	—	—	47	—	—	99	—	—	—	—	—
All types	1,546,816	29,426	33,851	38,742	174,737	305,283	269,380	235,800	171,622	114,724	90,440	69,931	12,880	—

Table 29.— *Net volume of sawtimber on commercial forest land by forest type and stand-age class, Central Hardwood Unit, Minnesota, 1977*

(In thousand board feet)[1]

Forest type	All classes	Stand-age class (years)												
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
Jack pine	20,149	—	—	2,050	5,813	5,640	—	6,646	—	—	—	—	—	—
Red pine	12,119	—	—	1,033	—	2,538	—	—	—	8,548	—	—	—	—
White pine	37,916	—	—	—	—	—	15,180	17,406	5,330	—	—	—	—	—
Balsam fir	8,269	—	—	—	—	6,904	1,365	—	—	—	—	—	—	—
White spruce	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Black spruce	2,245	—	—	2,245	—	—	—	—	—	—	—	—	—	—
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Tamarack	34,029	—	1,433	—	285	4,205	8,348	4,966	442	5,548	3,650	3,343	1,809	—
Oak	1,732,987	5,798	18,550	2,725	58,952	147,618	250,437	327,801	212,323	242,769	271,256	171,188	23,570	—
Elm-ash-cottonwood	340,906	5,568	7,204	5,942	6,406	59,253	65,833	74,588	66,911	8,893	27,307	2,245	10,756	—
Maple-basswood	1,645,017	17,067	11,972	12,162	59,289	132,003	247,164	350,611	365,486	195,417	92,600	139,941	21,305	—
Aspen	596,370	38,246	21,508	15,840	113,607	167,587	150,259	46,083	37,523	5,717	—	—	—	—
Paper birch	105,681	690	1,014	1,106	17,806	26,213	19,612	11,034	13,277	14,139	—	790	—	—
Balsam poplar	13,067	824	1,698	—	—	4,514	4,976	—	—	1,055	—	—	—	—
Nonstocked	4,999	3,753	—	—	—	510	—	—	736	—	—	—	—	—
All types	4,553,754	71,946	63,379	43,103	262,158	556,985	763,174	839,135	702,028	482,086	394,813	317,507	57,440	—

[1]International ¼-inch rule.

Table 30.— *Net volume of short-log trees on commercial forest land by species and diameter class, Central Hardwood Unit, Minnesota, 1977*

(In thousand cubic feet)

Species	All classes	Diameter class (inches at breast height)									
		9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS:											
White pine	86	—	—	—	—	—	—	—	—	86	—
Red pine	44	44	—	—	—	—	—	—	—	—	—
Jack pine	164	125	39	—	—	—	—	—	—	—	—
White spruce	—	—	—	—	—	—	—	—	—	—	—
Black spruce	—	—	—	—	—	—	—	—	—	—	—
Balsam fir	86	86	—	—	—	—	—	—	—	—	—
Tamarack	39	—	39	—	—	—	—	—	—	—	—
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—
Other softwoods	87	87	—	—	—	—	—	—	—	—	—
Total	506	342	78	—	—	—	—	—	—	86	—
HARDWOODS:											
Select white oaks	10,221	—	2,357	1,011	2,140	1,300	1,013	894	940	566	—
Select red oaks	8,129	—	1,126	1,641	1,216	1,367	634	1,021	976	148	—
Other red oaks	385	—	43	115	—	71	89	67	—	—	—
Hickory	200	—	37	96	—	—	67	—	—	—	—
Yellow birch	—	—	—	—	—	—	—	—	—	—	—
Hard maple	3,220	—	505	634	598	383	701	—	309	90	—
Soft maple	559	—	—	28	44	18	—	—	—	120	349
Ash	1,137	—	455	316	176	134	56	—	—	—	—
Balsam poplar	—	—	—	—	—	—	—	—	—	—	—
Paper birch	759	—	298	329	132	—	—	—	—	—	—
Bigtooth aspen	471	—	260	128	—	83	—	—	—	—	—
Quaking aspen	3,274	—	1,520	856	720	79	—	—	99	—	—
Basswood	3,489	—	1,035	692	440	66	144	90	894	128	—
Elm	5,902	—	801	636	642	524	766	511	901	618	503
Select hardwoods	489	—	6	83	181	73	—	45	101	—	—
Other hardwoods	1,203	—	335	225	62	88	49	62	211	171	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—
Total	39,438	—	8,778	6,790	6,351	4,186	3,519	2,690	4,431	1,841	852
All species	39,944	342	8,856	6,790	6,351	4,186	3,519	2,690	4,431	1,927	852

Table 31.— *Net volume of short-log trees on commercial forest land by species and diameter class, Central Hardwood Unit, Minnesota, 1977*

(In thousand board feet)[1]

Species	All classes	Diameter class (inches at breast height)									
		9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS:											
White pine	330	—	—	—	—	—	—	—	—	330	—
Red pine	242	242	—	—	—	—	—	—	—	—	—
Jack pine	614	382	232	—	—	—	—	—	—	—	—
White spruce	—	—	—	—	—	—	—	—	—	—	—
Black spruce	—	—	—	—	—	—	—	—	—	—	—
Balsam fir	262	262	—	—	—	—	—	—	—	—	—
Tamarack	434	—	434	—	—	—	—	—	—	—	—
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	
Other softwoods	507	507	—	—	—	—	—	—	—	—	—
Total	2,389	1,393	666	—	—	—	—	—	—	330	—
HARDWOODS:											
Select white oaks	35,004	—	9,674	3,362	6,991	3,909	2,690	2,802	3,469	2,107	—
Select red oaks	24,645	—	4,085	5,563	3,676	3,716	1,616	2,867	2,595	527	—
Other red oaks	1,253	—	138	474	—	201	250	190	—	—	—
Hickory	700	—	119	381	—	—	200	—	—	—	—
Yellow birch	—	—	—	—	—	—	—	—	—	—	—
Hard maple	7,602	—	1,450	1,355	1,322	876	1,540	—	780	279	—
Soft maple	2,175	—	—	326	349	123	—	—	—	319	1,058
Ash	2,555	—	1,438	672	144	158	143	—	—	—	—
Balsam poplar	—	—	—	—	—	—	—	—	—	—	—
Paper birch	1,449	—	617	581	251	—	—	—	—	—	—
Bigtooth aspen	762	—	367	172	—	223	—	—	—	—	—
Quaking aspen	6,149	—	2,579	1,493	1,383	194	—	—	500	—	—
Basswood	9,850	—	1,917	1,227	751	117	344	300	4,205	989	—
Elm	24,268	—	3,593	2,733	2,371	2,155	2,514	1,713	3,552	2,486	3,151
Select hardwoods	1,656	—	56	30	743	386	—	203	238	—	—
Other hardwoods	6,048	—	1,695	952	552	572	341	363	514	1,059	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—
Total	124,116	—	27,728	19,321	18,533	12,630	9,638	8,438	15,853	7,766	4,209
All species	126,505	1,393	28,394	19,321	18,533	12,630	9,638	8,438	15,853	8,096	4,209

[1]International ¼-inch rule.

Table 32.—*Net annual growth of growing stock on commercial forest land by softwoods and hardwoods, Central Hardwood Unit, Minnesota, 1961 and 1976*

(In thousand cubic feet)

Species	1961[1]	1976
Softwoods	2,243	3,562
Hardwoods	43,656	58,733
All species	45,899	62,295

[1]Figures have been adjusted from those published after the 1962 survey to conform to 1977 volumes because of changes in survey definitions and procedures.

Table 33.— *Net annual growth of growing stock on commercial forest land by species and county, Central Hardwood Unit, Minnesota, 1976*

(In thousand cubic feet)

Species	All counties	Anoka	Benton	Carver	Chisago	Dakota	Douglas	Fillmore	Goodhue	Hennepin	Houston	Isanti	Kanabec	Le Sueur	Mille Lacs
SOFTWOODS:															
White pine	453	2	8	1	3	—	2	16	7	—	11	2	30	—	26
Red pine	1,113	40	90	2	103	6	2	16	28	2	12	175	26	2	21
Jack pine	649	21	68	–1	66	–1	—	9	15	–1	5	121	–1	–2	–2
White spruce	126	1	2	—	2	1	—	—	—	—	—	2	6	—	4
Black spruce	211	2	—	—	5	1	—	—	—	—	—	9	13	—	12
Balsam fir	402	2	2	—	7	3	2	2	3	1	2	6	28	1	28
Tamarack	508	-6	6	—	24	–36	10	5	–10	–4	–2	37	21	–7	24
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other softwoods	100	1	1	—	2	1	1	6	4	—	5	2	5	—	6
Total	3,562	63	177	2	212	–25	17	54	47	–2	33	354	128	–6	119
HARDWOODS:															
Select white oak	4,294	67	74	22	88	–6	39	224	171	9	388	75	224	6	207
Select red oak	9,025	139	107	39	186	88	48	366	393	25	763	170	624	38	552
Other red oaks	214	4	6	1	3	1	1	12	16	—	36	3	7	—	4
Hickory	429	8	10	3	8	2	1	26	29	1	74	5	15	2	8
Yellow birch	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Hard maple	4,335	62	54	26	110	33	40	84	112	19	237	77	299	31	379
Soft maple	2,940	57	27	25	83	41	19	39	58	21	82	53	250	34	230
Ash	1,538	44	19	14	67	24	20	10	18	12	35	58	126	19	121
Balsam poplar	833	11	8	2	16	5	11	26	18	2	45	19	55	2	53
Paper birch	3,761	37	43	9	59	16	35	124	103	5	218	62	277	7	243
Bigtooth aspen	332	2	14	1	8	—	5	-24	–14	1	5	2	5	1	33
Quaking aspen	11,430	92	118	19	152	68	107	313	197	15	269	162	1,012	20	869
Basswood	8,516	153	103	51	228	57	78	273	222	39	370	168	613	47	640
Elm	10,307	224	101	66	326	152	130	257	186	61	121	284	797	81	928
Select hardwoods	306	6	7	2	6	3	3	9	14	1	52	5	10	1	10
Other hardwoods	470	–6	14	2	2	–13	8	32	30	–6	74	11	16	1	7
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	58,733	900	705	282	1,342	471	545	1,771	1,553	205	2,769	1,154	4,330	290	4,284
All species	62,295	963	882	284	1,554	446	562	1,825	1,600	203	2,802	1,508	4,458	284	4,403

(Table 33 continued on next page)

(Table 33 continued)

Species	Morrison	Olmsted	Otter Tail	Pine	Ramsey	Rice	Scott	Sherburne	Stearns	Todd	Wabasha	Washington	Winona	Wright
SOFTWOODS:														
White pine	22	8	62	186	—	1	—	9	15	15	10	—	11	6
Red pine	95	7	32	310	—	1	3	85	7	13	13	2	15	5
Jack pine	51	3	13	220	—	—	–2	56	2	–1	4	–2	7	1
White spruce	2	—	9	89	—	—	—	—	1	6	—	—	—	1
Black spruce	5	—	18	139	—	—	—	4	—	2	—	1	—	—
Balsam fir	11	1	51	212	—	1	1	9	3	17	2	2	2	3
Tamarack	26	5	89	316	—	1	–2	3	2	2	—	–4	—	8
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other softwoods	10	2	13	6	—	—	—	16	2	4	5	—	6	2
Total	222	26	287	1,478	—	4	—	182	32	58	34	–1	41	26
HARDWOODS:														
Select white oak	386	110	332	635	—	19	24	178	183	191	180	4	376	88
Select red oak	698	161	762	1,482	—	32	47	329	272	405	350	35	753	161
Other red oak	19	6	5	5	—	—	1	13	17	4	12	—	34	4
Hickory	39	12	9	6	—	2	3	28	28	8	24	1	69	8
Yellow birch	—	—	—	3	—	—	—	—	—	—	—	—	—	—
Hard maple	234	41	588	893	—	43	39	92	108	332	81	27	211	83
Soft maple	143	18	320	955	—	38	39	36	49	147	40	34	68	34
Ash	100	10	172	418	—	19	21	14	29	95	15	19	20	19
Balsam poplar	63	12	93	218	—	3	3	18	19	49	22	2	43	15
Paper birch259	54	394	1,037	—	11	11	93	98	172	107	7	217	63	
Bigtooth aspen	–16	-8	54	287	—	3	2	-5	18	-10	–20	2	–9	–5
Quaking aspen	692	131	1,384	4,055	—	35	22	165	198	569	246	29	312	179
Basswood	621	136	898	1,900	—	70	67	192	243	544	230	49	363	161
Elm	749	134	1,404	2,270	—	102	92	136	185	867	219	85	134	216
Select hardwoods	19	5	16	30	—	1	2	17	18	12	9	1	43	4
Other hardwoods	50	13	27	39	—	2	4	28	27	15	19	–9	69	14
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	4,056	835	6,458	14,233	—	380	377	1,334	1,492	3,400	1,534	286	2,703	1,044
All species	4,278	861	6,745	15,711	—	384	377	1,516	1,524	3,458	1,568	285	2,744	1,070

Table 34.— *Net annual growth of sawtimber on commercial forest land by species and county, Central Hardwood Unit, Minnesota, 1976*

(In thousand board feet)[1]

Species	All counties	Anoka	Benton	Carver	Chisago	Dakota	Douglas	Fillmore	Goodhue	Hennepin	Houston	Isanti	Kanabec	Le Sueur	Mille Lacs
SOFTWOODS:															
White pine	2,560	2	41	2	2	–3	10	66	28	–2	46	–7	211	–6	162
Red pine	1,064	31	11	7	27	20	3	56	41	6	49	27	77	7	57
Jack pine	981	24	80	–2	66	–2	6	62	28	–2	23	134	–3	–4	–14
White spruce	347	—	3	—	6	—	2	—	—	—	2	4	13	—	11
Black spruce	10	—	—	—	—	1	—	—	—	—	—	—	3	—	1
Balsam fir	864	1	1	—	6	—	3	5	4	—	5	8	27	—	24
Tamarack	2,743	39	22	10	180	–54	37	26	–7	2	1	227	138	1	150
Other softwoods	71	1	—	—	2	—	2	4	3	—	3	3	4	—	4
Total	8,640	98	158	17	289	–38	63	219	97	4	129	396	470	–2	395
HARDWOODS:															
Select white oak	16,546	328	307	101	422	–20	158	1,015	797	40	1,806	366	723	37	603
Select red oak	38,201	545	577	167	782	253	206	1,700	2,052	83	4,669	678	2,032	130	1,973
Other red oaks	909	14	26	5	15	3	4	52	58	1	160	12	28	2	16
Hickory	1,456	33	26	6	23	5	23	152	70	3	154	30	42	4	14
Yellow birch	18	—	—	—	—	—	—	—	—	—	—	—	2	—	2
Hard maple	19,508	451	309	188	597	138	178	493	580	116	1,371	413	1,152	162	1,429
Soft maple	10,481	357	55	111	425	412	76	249	350	120	357	336	847	191	932
Ash	5,078	193	174	140	342	83	–9	117	253	90	365	91	278	184	–2
Balsam poplar	812	11	10	3	14	6	7	29	29	1	75	14	52	3	43
Paper birch	3,715	47	63	8	104	44	21	81	72	9	103	72	338	14	316
Bigtooth aspen	–665	–4	21	1	–13	–1	–20	–88	–50	1	–19	–32	–12	2	–109
Quaking aspen	34,262	231	281	50	420	262	203	417	444	53	508	417	3,665	83	2,888
Basswood	27,208	614	477	234	871	191	222	1,157	966	169	1,672	532	1,619	201	1,798
Elm	34,852	947	291	232	1,275	809	496	950	615	252	131	1,186	2,763	311	3,155
Select hardwoods	1,564	24	37	9	24	6	4	65	111	2	356	15	37	4	22
Other hardwoods	3,358	127	63	88	200	19	15	153	197	56	352	74	137	103	74
Total	197,303	3,918	2,717	1,343	5,501	2,210	1,584	6,542	6,544	996	12,060	4,204	13,703	1,431	13,154
All species	205,943	4,016	2,875	1,360	5,790	2,172	1,647	6,761	6,641	1,000	12,189	4,600	14,173	1,429	13,549

[1]International ¼-inch rule.

(Table 34 continued on next page)

(Table 34 continued)

Species	Morrison	Olmsted	Otter Tail	Pine	Ramsey	Rice	Scott	Sherburne	Stearns	Todd	Wabasha	Washington	Winona	Wright
SOFTWOODS:														
White pine	81	32	349	1,273	—	2	–2	35	61	70	35	–2	50	24
Red pine	105	30	73	197	—	4	9	38	29	38	47	7	52	16
Jack pine	121	23	5	251	—	–2	–3	83	16	9	36	–4	37	13
White spruce	3	—	26	253	—	1	—	1	2	18	—	—	—	2
Black spruce	1	—	—	3	—	—	—	1	—	—	—	—	—	—
Balsam fir	14	2	57	658	—	1	—	5	2	26	4	—	6	5
Tamarack	208	23	270	1,277	—	10	12	9	16	66	27	21	1	31
Other softwoods	12	2	8	5	—	—	—	2	1	5	3	—	4	3
Total	545	112	788	3,917	—	16	16	174	127	232	152	22	150	94
HARDWOODS:														
Select white oak	1,722	497	953	1,268	—	82	113	812	799	646	834	20	1,749	368
Select red oak	3,005	752	2,914	3,344	—	132	202	1,850	1,542	1,667	1,664	87	4,450	745
Other red oak		25	20	8	—	1	5	58	76	19	50	—	150	18
Hickory	243	65	22	2	—	5	10	69	78	61	108	2	164	42
Yellow birch	—	—	2	12	—	—	—	—	—	—	—	—	—	—
Hard maple	1,201	321	2,176	3,150	—	226	250	586	650	1,337	419	137	1,135	343
Soft maple	851	109	1,013	1,179	—	146	175	173	195	838	288	188	325	183
Ash	262	41	–195	1,433	—	216	228	121	308	–178	96	145	271	31
Balsam poplar	59	13	64	176	—	2	4	28	26	33	26	2	70	12
Paper birch	195	35	421	1,138	—	27	17	49	91	201	74	16	99	60
Bigtooth aspen	–140	–32	–197	404	—	–3	3	–27	16	–187	–70	6	–56	–59
Quaking aspen	1,325	171	4,337	15,000	—	85	64	272	309	1,342	418	130	553	334
Basswood	2,246	580	2,484	3,705	—	307	304	852	1,074	1,593	951	198	1,620	571
Elm	2,958	515	4,492	6,671	—	325	307	364	599	3,011	855	357	232	753
Cottonwood	104	34	25	18	—	2	11	121	110	24	69	1	310	19
Black walnut		62	71	121	—	135	138	123	138	75	125	82	303	65
Other hardwoods	262	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	14,376	3,188	18,602	37,629	—	1,688	1,831	5,451	6,011	10,482	5,907	1,371	11,375	3,485
All species	14,921	3,300	19,390	41,546	—	1,704	1,847	5,625	6,138	10,714	6,059	1,393	11,525	3,579

Table 35.— *Net annual growth of growing stock on commercial forest land by species and ownership class, Central Hardwood Unit, Minnesota, 1976*

(In thousand cubic feet)

Species	All owners	Ownership class												
		National forest	Bureau of Land Mgmt.	Indian	Misc. federal	State	County & municipal	Forest industry	Farmer	Farmer owned-leased	Misc. priv.-corp.	Misc. priv.-indiv.	Misc. priv.-corp., leased	Misc. priv.-indiv., leased
SOFTWOODS:														
White pine	453	—	—	—	—	–22	12	—	413	—	2	48	—	—
Red pine	1,113	—	—	—	2	125	16	—	199	—	—	771	—	—
Jack pine	649	—	—	—	—	–76	—	10	282	—	—	433	—	—
White spruce	126	—	—	—	—	37	—	—	35	—	—	54	—	—
Black spruce	211	—	—	—	—	113	—	—	19	—	5	74	—	—
Balsam fir	402	—	—	—	—	124	—	—	84	—	—	194	—	—
Tamarack	508	—	—	—	—	92	—	—	–18	—	22	412	—	—
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other softwoods	100	—	—	—	—	26	—	—	69	—	—	5	—	—
Total	3,562	—	—	—	2	419	28	10	1,083	—	29	1,991	—	—
HARDWOODS:														
Select white oaks	4,294	—	—	15	6	504	55	1	3,302	—	110	298	—	3
Select red oaks	9,025	—	—	31	54	997	230	—	5,035	—	113	2,565	—	—
Other red oaks	214	—	—	—	6	26	—	—	172	—	—	10	—	—
Hickory	429	—	—	8	9	6	1	—	364	—	—	41	—	—
Yellow birch	3	—	—	—	—	2	1	—	—	—	—	—	—	—
Hard maple	4,335	—	—	23	14	787	198	—	2,655	—	50	608	—	—
Soft maple	2,940	—	—	20	389	614	87	—	867	—	85	878	—	—
Ash	1,538	—	—	—	–104	269	94	—	721	—	102	456	—	—
Balsam poplar	833	—	—	—	—	40	5	—	627	—	6	155	—	—
Paper birch	3,761	—	—	6	8	870	94	—	1,622	—	121	1,040	—	—
Bigtooth aspen	332	—	—	12	—	299	62	—	–196	—	43	112	—	—
Quaking aspen	11,430	—	—	19	30	2,540	–964	—	4,309	—	857	4,639	—	—
Basswood	8,516	—	—	173	29	684	452	—	5,224	—	280	1,637	—	37
Elm	10,307	—	—	9	153	1,050	209	—	6,960	—	298	1,522	—	106
Select hardwoods	306	—	—	—	—	56	11	—	162	—	16	61	—	—
Other hardwoods	470	—	—	—	94	75	—	—	113	—	40	148	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	58,733	—	—	316	688	8,819	535	1	31,937	—	2,121	14,170	—	146
All species	62,295	—	—	316	690	9,238	563	11	33,020	—	2,150	16,161	—	146

Table 36.— *Net annual growth of sawtimber on commercial forest land by species and ownership class, Central Hardwood Unit, Minnesota, 1976*

(In thousand board feet)[1]

Species	All owners	Ownership class								
		Indian	Misc. federal	State	County & municipal	Forest industry	Farmer	Misc. priv.-corp.	Misc. priv.-indiv.	Misc. priv.-indiv., leased
SOFTWOODS:										
White pine	2,560	—	—	–322	65	—	2,610	9	198	—
Red pine	1,064	—	10	234	77	—	578	—	165	—
Jack pine	981	—	—	–280	—	4	496	—	761	—
White spruce	347	—	—	170	—	—	87	—	90	—
Black spruce	10	—	—	3	—	—	7	—	—	—
Balsam fir	864	—	—	41	—	—	197	—	626	—
Tamarack	2,743	—	—	196	—	—	–200	21	2,726	—
Northern white-cedar	—	—	—	—	—	—	—	—	—	—
Other softwoods	71	—	—	—	—	—	53	1	17	—
Total	8,640	—	10	42	142	4	3,828	31	4,583	—
HARDWOODS:										
Select white oaks	16,546	—	—	588	33	—	14,607	827	478	13
Select red oaks	38,201	46	131	4,026	434	—	26,735	–714	7,543	—
Other red oaks	909	—	31	53	—	—	800	—	25	—
Hickory	1,456	—	16	8	7	—	1,401	—	24	—
Yellow birch	18	—	—	10	8	—	—	—	—	—
Hard maple	19,508	28	89	1,416	797	—	15,818	26	1,334	—
Soft maple	10,481	—	1,487	148	14	—	5,948	39	2,845	—
Ash	5,078	—	2,403	373	1,317	—	177	131	677	—
Balsam poplar	812	—	—	23	—	—	669	—	120	—
Paper birch	3,715	—	—	905	37	—	1,834	51	888	—
Bigtooth aspen	–665	21	—	402	149	—	–1,054	24	–207	—
Quaking aspen	34,262	49	597	9,270	1,187	—	6,348	3,314	13,497	—
Basswood	27,208	145	78	2,760	418	—	16,359	1,987	5,276	185
Elm	34,852	—	95	4,218	404	—	23,159	723	5,783	470
Select hardwoods	1,564	—	—	251	—	—	1,231	24	58	—
Other hardwoods	3,358	—	369	138	—	—	2,702	73	76	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—
Total	197,303	289	5,296	24,589	4,805	—	116,734	6,505	38,417	668
All species	205,943	289	5,306	24,631	4,947	4	120,562	6,536	43,000	668

[1]International ¼-inch rule.

Table 37.— *Net annual growth of growing stock on commercial forest land by species and forest type, Central Hardwood Unit, Minnesota, 1977*

(In thousand cubic feet)

Species	All types	Forest type														
		Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar	Tamarack	Oak-hickory	Elm-ash-cottonwood	Maple-basswood	Aspen	Paper birch	Balsam poplar	Non-stocked
SOFTWOODS:																
White pine	453	7	—	224	13	—	6	—	5	48	9	101	–6	46	—	—
Red pine	1,113	76	810	25	—	—	—	—	—	64	—	—	119	19	—	—
Jackpine	649	671	25	—	—	—	—	—	—	1	—	—	–56	8	—	—
White spruce	126	—	—	—	17	—	—	—	9	7	27	9	47	3	7	—
Black spruce	211	—	—	—	30	—	113	—	29	—	2	1	30	6	—	—
Balsam fir	402	10	—	—	99	—	22	—	10	—	35	26	144	56	—	—
Tamarack	508	—	8	—	24	—	63	—	709	—	–192	93	–261	44	8	12
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other softwoods	100	—	25	—	—	—	—	—	—	45	—	23	1	6	—	—
Total	3,562	764	868	249	183	—	204	—	762	165	–119	253	18	188	15	12
HARDWOODS:																
Select white oaks	4,294	1	—	9	—	—	—	—	—	2,663	53	748	750	62	4	4
Select red oaks	9,025	—	12	12	—	—	3	—	6	5,643	327	1,253	1,557	208	4	—
Other red oaks	214	—	—	—	—	—	—	—	—	162	4	33	12	—	3	—
Hickory	429	—	—	—	—	—	—	—	—	346	—	69	—	14	—	—
Yellow birch	3	—	—	—	—	—	—	—	—	—	3	—	—	—	—	—
Hard maple	4,335	—	—	—	—	—	—	—	—	341	67	3,549	362	16	—	—
Soft maple	2,940	—	—	2	3	—	—	—	7	141	629	668	1,390	100	—	—
Ash	1,538	—	—	11	—	—	2	—	1	152	581	496	241	41	8	5
Balsam poplar	833	—	—	—	—	—	—	—	7	33	—	63	410	22	298	—
Paper birch	3,761	4	6	8	4	—	9	—	—	928	24	549	1,489	731	3	6
Bigtooth aspen	332	—	—	—	—	—	3	—	—	192	—	–240	665	–289	1	—
Quaking aspen	11,430	60	53	2	14	—	32	—	23	624	–12	646	9,501	443	18	26
Basswood	8,516	—	—	—	3	—	—	—	—	1,254	141	5,477	1,525	116	—	—
Elm	10,307	—	—	—	—	—	—	—	43	1,655	846	6,236	1,243	201	53	30
Select hardwoods	306	—	—	—	—	—	—	—	—	71	14	138	68	9	3	3
Other hardwoods	470	—	—	—	—	—	—	—	—	108	282	32	42	—	—	6
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	58,733	65	71	44	24	—	49	—	87	14,313	2,959	19,717	19,255	1,674	395	80
All species	62,295	829	939	293	207	—	253	—	849	14,478	2,840	19,970	19,273	1,862	410	92

Table 38.— *Net annual growth of sawtimber on commercial forest land by species and forest type, Central Hardwood Unit, Minnesota, 1976*

(In thousand board feet)[1]

Species	All types	Forest type														
		Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar	Tamarack	Oak-hickory	Elm-ash-cottonwood	Maple-basswood	Aspen	Paper birch	Balsam poplar	Non-stocked
SOFTWOODS:																
White pine	2,560	15	—	1,695	70	—	16	—	13	246	21	462	-175	197	—	—
Red pine	1,064	97	187	120	—	—	—	—	—	207	—	—	358	95	—	—
Jack pine	981	846	37	—	—	—	—	—	—	3	—	—	80	15	—	—
White spruce	347	—	—	—	63	—	—	—	—	—	9	22	212	14	27	—
Black spruce	10	—	—	—	3	—	—	—	—	—	—	—	7	—	—	—
Balsam fir	864	22	—	—	146	—	—	—	—	—	18	36	614	28	—	—
Tamarack	2,743	—	—	—	22	—	1,419	—	1,912	—	52	151	-1,845	1,003	29	—
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other	71	—	—	—	—	—	—	—	—	46	—	25	—	—	—	—
Total	8,640	980	224	1,815	304	—	1,435	—	1,925	502	100	696	-749	1,352	56	—
HARDWOODS:																
Select white oaks	16,546	—	—	13	—	—	—	—	—	10,915	203	4,213	954	218	23	7
Select red oaks	38,201	—	—	62	—	—	—	—	34	26,880	13	4,431	5,467	1,290	24	—
Other red oaks	909	—	—	—	—	—	—	—	—	678	23	161	30	—	17	—
Hickory	1,456	—	—	—	—	—	—	—	—	457	—	943	—	56	—	—
Yellow birch	18	—	—	—	—	—	—	—	—	—	18	—	—	—	—	—
Hard maple	19,508	—	—	—	—	—	—	—	—	720	174	18,039	575	—	—	—
Soft maple	10,481	—	—	6	—	—	—	—	—	1,949	2,275	884	5,339	28	—	—
Ash	5,078	—	—	9	—	—	—	—	—	191	3,213	1,397	216	31	10	11
Balsam poplar	812	—	—	—	—	—	—	—	—	79	—	135	370	20	208	—
Paper birch	3,715	—	—	17	—	—	—	—	—	525	497	335	1,111	1,230	—	—
Bigtooth aspen	-665	—	—	—	—	—	—	—	—	326	—	-1,462	1,985	-1,514	—	—
Quaking aspen	34,262	—	72	15	—	—	18	—	—	2,783	-452	781	30,081	909	22	33
Basswood	27,208	—	—	—	16	—	—	—	—	4,175	413	21,091	1,377	136	—	—
Elm	34,852	—	—	—	—	—	—	—	—	2,625	2,170	20,986	7,803	1,032	161	75
Select hardwoods	1,564	—	—	—	—	—	—	—	—	1,056	—	411	64	33	—	—
Other hardwoods	3,358	—	—	—	—	—	—	—	—	116	1,847	1,341	36	—	—	18
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	197,303	—	72	122	16	—	18	—	34	53,475	10,394	73,686	55,408	3,469	465	144
All species	205,943	980	296	1,937	320	—	1,453	—	1,959	53,977	10,494	74,382	54,659	4,821	521	144

[1]International ¼-inch rule.

Table 39.— *Net annual growth of growing stock on commercial forest land by forest type and stand-age class, Central Hardwood Unit, Minnesota, 1976*

(In thousand cubic feet)

Forest type	All classes	Stand-age class (years)											
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140
Jack pine	829	—	—	229	457	110	—	33	—	—	—	—	—
Red pine	939	—	682	110	—	66	—	—	—	81	—	—	—
White pine	293	—	—	—	—	—	128	125	40	—	—	—	—
Balsam fir	207	—	17	—	—	174	16	—	—	—	—	—	—
White spruce	—	—	—	—	—	—	—	—	—	—	—	—	—
Black spruce	253	—	5	88	7	12	92	49	—	—	—	—	—
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—
Tamarack	649	—	79	25	20	258	150	72	21	66	47	66	45
Oak-hickory	14,478	76	219	–81	1,149	3,288	2,384	2,768	1,664	366	1,621	893	131
Elm-ash-cottonwood	2,840	9	203	121	399	948	314	461	–36	109	241	26	45
Maple-basswood	19,970	284	274	796	1,957	2,812	3,111	3,588	3,150	1,733	891	1,176	198
Aspen	19,273	–1,828	1,111	1,509	6,513	6,997	3,438	988	474	71	—	—	—
Paper birch	1,862	6	48	100	503	754	155	–22	185	127	—	6	—
Balsam poplar	410	4	7	—	—	205	144	—	—	50	—	—	—
Nonstocked	92	84	5	—	—	1	—	—	2	—	—	—	—
All types	62,295	–1,365	2,650	2,897	11,005	15,625	9,932	8,062	5,500	2,603	2,800	2,167	419

Table 40.— *Net annual growth of sawtimber on commercial forest land by forest type and stand-age class, Central Hardwood Unit, Minnesota, 1976*

(In thousand board feet)[1]

Forest type	All classes	Stand-age class (years)											
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140
Jack pine	980	—	—	72	661	147	—	100	—	—	—	—	—
Red pine	296	—	—	22	—	68	—	—	—	206	—	—	—
White pine	1,937	—	—	—	—	—	1,284	503	150	—	—	—	—
Balsam fir	320	—	—	—	—	274	46	—	—	—	—	—	—
White spruce	—	—	—	—	—	—	—	—	—	—	—	—	—
Black spruce	1,453	—	—	581	—	—	872	—	—	—	—	—	—
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—
Tamarack	1,959	—	59	—	12	120	1,232	136	21	107	144	94	34
Oak-hickory	53,977	185	523	64	1,184	7,064	6,563	13,505	10,151	931	9,039	4,217	551
Elm-ash-cottonwood	10,494	–409	272	971	1,274	3,418	530	2,528	862	275	553	61	159
Maple-basswood	74,382	1,935	1,528	600	8,227	6,216	14,070	8,409	13,999	8,620	4,125	5,796	857
Aspen	54,659	–54	4,587	3,456	11,388	16,274	8,367	7,572	2,910	159	—	—	—
Paper birch	4,821	22	33	33	2,758	2,085	–518	–677	400	674	—	11	—
Balsam poplar	521	23	27	—	—	227	215	—	—	29	—	—	—
Nonstocked	144	121	—	—	—	7	—	—	16	—	—	—	—
All types	205,943	1,823	7,029	5,799	25,504	35,900	32,661	32,076	28,509	11,001	13,861	10,179	1,601

[1]International ¼-inch rule.

Table 41.—*Timber removals from growing stock and sawtimber on commercial forest land by species, Central Hardwood Unit, Minnesota, 1962 and 1976*

Species	Growing stock		Sawtimber	
	1962	1976	1962	1976
	Thousand cubic feet		*Thousand board feet*[1]	
SOFTWOODS:				
White pine	274	186	1,314	523
Red pine	151	132	636	405
Jack pine	411	484	1,039	1,296
Spruce	102	41	317	58
Balsam fir	133	119	192	108
Tamarack	590	304	758	318
Northern white-cedar	—	1	—	8
Other softwoods	43	72	30	50
Total	1,704	1,339	4,286	2,766
HARDWOODS:				
White oak	3,302	3,136	8,802	7,494
Red oak	5,126	7,554	17,218	21,036
Yellow birch	35	5	62	10
Hard maple	598	813	1,654	2,103
Soft maple	1,077	2,356	3,256	4,971
Ash	1,332	2,893	3,065	4,861
Paper birch	444	1,265	426	1,012
Aspen	2,876	5,542	5,289	14,560
Basswood	1,904	2,000	8,476	5,353
Elm	2,876	4,620	9,583	11,371
Other hardwoods	1,373	2,674	4,455	6,465
Total	20,943	32,858	62,286	79,236
All species	22,647	34,197	66,572	82,002

[1]International ¼-inch rule.

Table 42.— *Growing-stock removals on commercial forest land by species and county, Central Hardwood Unit, Minnesota, 1976*

(In thousand cubic feet)

Species	All counties	Anoka	Benton	Carver	Chisago	Dakota	Douglas	Fillmore	Goodhue	Hennepin	Houston	Isanti	Kanabec	Le Sueur	Mille Lacs
SOFTWOODS:															
White pine	186	3	1	1	1	4	3	8	2	1	3	3	12	1	12
Red pine	132	3	3	—	—	1	1	3	4	—	3	1	1	—	2
Jack pine	484	—	—	—	—	—	—	—	—	—	—	—	—	—	—
White spruce	20	—	—	—	—	—	—	—	—	—	—	—	3	—	1
Black spruce	21	—	—	—	—	—	3	—	—	—	—	1	—	—	1
Balsam fir	119	6	—	3	3	10	2	1	1	1	—	4	7	1	10
Tamarack	304	15	—	7	12	29	9	1	1	7	1	14	19	5	27
Northern white-cedar	1	1	—	—	—	—	—	2	—	—	—	—	—	—	—
Other softwoods	72	2	—	—	—	3	1	3	1	3	1	4	—	4	
Total	1,339	30	4	11	16	47	19	15	11	10	10	24	46	7	57
HARDWOODS:															
Select white oak	3,136	126	94	20	22	55	81	291	88	57	244	71	111	24	119
Select red oak	7,255	223	169	25	41	121	123	699	272	90	1,052	117	265	60	367
Other red oak	299	10	12	5	2	3	4	36	12	2	53	3	6	2	4
Hickory	182	9	9	—	—	3	2	12	9	2	28	3	4	1	3
Yellow birch	5	—	—	—	—	—	—	—	—	—	—	—	1	—	1
Hard maple	813	7	3	15	4	7	6	56	12	3	10	6	86	24	83
Soft maple	2,356	162	8	230	122	121	25	77	56	89	55	60	69	81	74
Ash	2,893	124	21	102	94	162	99	146	56	44	51	108	200	55	221
Balsam poplar	207	1	2	—	2	—	3	49	1	—	50	2	5	—	6
Paper birch	1,265	18	28	1	16	11	30	11	15	7	29	22	71	2	91
Bigtooth aspen	577	4	8	—	2	1	3	2	3	3	11	3	39	1	193
Quaking aspen	4,965	25	34	4	21	18	32	38	17	7	33	29	352	3	1,635
Basswood	2,000	24	13	14	8	21	17	102	60	11	58	14	192	34	230
Elm	4,620	168	36	148	85	166	65	315	136	137	218	98	282	93	369
Cottonwood	199	2	—	—	—	—	—	12	30	—	16	—	44	11	20
Black walnut	54	—	—	—	—	—	—	2	10	—	13	—	—	2	—
Other hardwoods	2,032	138	9	163	109	51	55	185	34	65	53	73	49	46	44
Total	32,858	1,041	446	727	528	740	545	2,033	811	517	1,974	609	1,776	439	3,460
All species	34,197	1,071	450	738	544	787	564	2,048	822	527	1,984	633	1,822	446	3,517

(Table 42 continued on next page)

(Table 42 continued)

Species	Morrison	Olmsted	Otter Tail	Pine	Ramsey	Rice	Scott	Sherburne	Stearns	Todd	Wabasha	Washington	Winona	Wright
SOFTWOODS:														
White pine	23	1	18	65	—	1	1	—	1	6	3	1	5	6
Red pine	19	2	8	48	—	—	—	1	3	22	3	—	1	3
Jack pine	144	—	96	156	—	—	—	—	—	88	—	—	—	—
White spruce	—	—	4	11	—	1	—	—	—	—	—	—	—	—
Black spruce	1	—	4	9	—	—	—	—	1	1	—	—	—	—
Balsam fir	6	1	15	32	—	1	3	—	1	4	—	4	—	3
Tamarack	25	3	37	38	—	6	9	2	3	15	1	13	1	4
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other softwoods		1	7	4	—	1	—	2	3	6	3	—	2	6
Total	231	8	189	363	—	10	13	5	12	142	10	18	9	22
HARDWOODS:														
Select white oak	333	83	208	150	—	26	11	65	199	216	102	6	231	103
Select red oak	667	148	416	329	—	55	32	149	373	367	272	16	599	208
Other red oak	27	17	3	2	—	2	4	7	26	8	11	—	31	7
Hickory	27	3	3	1	—	2	—	6	19	7	8	—	12	9
Yellow birch	1	—	1	1	—	—	—	—	—	—	—	—	—	—
Hard maple	28	8	135	179	—	38	13	2	12	31	4	3	9	29
Soft maple	104	42	46	76	—	194	256	10	30	43	20	185	103	18
Ash	223	82	200	184	—	84	113	23	90	132	29	96	99	55
Balsam poplar	7	—	23	37	—	1	—	2	8	5	1	—	—	2
Paper birch	92	7	200	388	—	9	3	20	70	65	13	2	17	27
Bigtooth aspen	66	1	56	129	—	1	—	4	18	14	4	—	5	6
Quaking aspen	526	18	461	1,410	—	8	4	18	73	95	29	4	26	45
Basswood	109	31	305	358	—	60	13	9	64	85	26	7	50	85
Elm	280	126	353	356	—	178	139	41	155	172	70	108	189	137
Cottonwood	—	11	—	—	—	6	—	—	4	—	12	—	29	2
Black walnut	—	1	—	—	—	3	—	—	—	—	1	—	22	—
Other hardwoods	161	108	20	17	—	135	177	7	32	33	19	125	103	21
Total	2,651	686	2,430	3,617	—	802	765	363	1,173	1,273	621	552	1,525	754
All species	2,882	694	2,619	3,980	—	812	778	368	1,185	1,415	631	570	1,534	776

Table 43.— *Timber removals from sawtimber on commercial forest land by species and county, Central Hardwood Unit, Minnesota, 1976*

(In thousand board feet)[1]

Species	All counties	Anoka	Benton	Carver	Chisago	Dakota	Douglas	Fillmore	Goodhue	Hennepin	Houston	Isanti	Kanabec	Le Sueur	Mille Lacs
SOFTWOODS:															
White pine	523	7	3	2	2	10	7	20	3	2	9	7	30	2	41
Red pine	405	5	9	—	—	1	2	5	6	—	5	1	2	—	3
Jack pine	1,296	—	—	—	—	—	—	—	—	—	—	—	—	—	—
White spruce	54	—	—	—	—	—	—	—	—	—	—	—	6	—	2
Black spruce	4	—	—	—	—	—	1	—	—	—	—	—	—	—	—
Balsam fir	108	5	—	2	2	8	1	1	1	1	—	3	5	1	8
Tamarack	318	15	—	7	12	28	8	1	1	7	1	15	19	5	34
Northern white-cedar	8	5	1	—	—	—	—	2	—	—	—	—	—	—	—
Other softwoods	50	1	—	—	—	2	1	1	2	1	2	1	3	—	3
Total	2,766	38	13	11	16	49	20	30	13	11	17	27	65	8	91
HARDWOODS:															
Select white oak	7,494	222	191	84	48	90	131	1,198	186	94	814	146	199	68	235
Select red oak	20,026	437	352	41	92	217	210	3,074	703	168	4,203	229	564	162	792
Other red oak	1,010	24	29	11	5	6	9	171	37	5	242	8	16	5	11
Hickory	252	9	9	—	—	4	2	37	10	2	60	3	4	2	3
Yellow birch	10	—	—	—	—	—	—	—	—	—	—	—	2	—	3
Hard maple	2,103	13	7	71	9	25	11	276	53	5	37	10	169	125	205
Soft maple	4,971	319	17	452	244	238	50	159	199	175	134	119	151	189	172
Ash	4,861	190	31	186	144	241	146	304	129	64	84	160	313	113	403
Balsam poplar	603	1	3	—	3	—	4	240	1	—	241	3	4	—	6
Paper birch	1,012	12	25	1	18	6	32	8	8	3	23	22	59	1	88
Bigtooth aspen	1,852	6	16	—	6	1	5	3	3	3	25	4	161	1	1,037
Quaking aspen	12,708	35	69	3	38	15	36	41	14	6	68	32	1,249	4	6,846
Basswood	5,353	47	28	51	18	38	30	442	257	21	202	27	426	147	719
Elm	11,371	333	73	332	172	299	118	1,061	419	434	710	217	619	260	1,184
Select hardwoods	1,048	15	3	—	—	1	—	58	159	—	81	—	222	58	100
Other hardwoods	298	—	—	—	—	—	—	11	53	—	72	—	—	13	—
Noncommercial species	4,264	286	18	338	225	106	112	385	96	135	128	150	102	96	91
Total	79,236	1,949	871	1,570	1,022	1,287	896	7,468	2,327	1,115	7,124	1,130	4,260	1,244	11,895
All species	82,002	1,987	884	1,581	1,038	1,336	916	7,498	2,340	1,126	7,141	1,157	4,325	1,252	11,986

[1]International ¼-inch rule.

(Table 43 continued on next page)

(Table 43 continued)

Species	Morrison	Olmsted	Otter Tail	Pine	Ramsey	Rice	Scott	Sherburne	Stearns	Todd	Wabasha	Washington	Winona	Wright
SOFTWOODS:														
White pine	86	3	48	186	—	2	2	—	2	15	8	2	11	13
Red pine	65	3	16	160	—	—	—	1	5	104	5	—	2	5
Jack pine	403	—	239	390	—	—	—	—	—	264	—	—	—	—
White spruce	—	—	15	26	—	2	—	—	3	—	—	—	—	—
Black spruce	—	—	1	2	—	—	—	—	—	—	—	—	—	—
Balsam fir	5	1	11	41	—	1	2	—	1	3	—	3	—	2
Tamarack	24	3	43	41	—	6	9	2	2	16	1	13	1	4
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other softwoods	9	1	5	3	—	1	—	1	2	4	2	—	1	4
Total	592	11	378	849	—	12	13	4	15	406	16	18	15	28
HARDWOODS:														
Select white oak	572	187	439	247	—	62	35	123	368	421	263	10	889	172
Select red oak	1,215	430	938	621	—	134	87	315	712	770	829	24	2,332	375
Other red oak	62	47	11	3	—	4	10	18	59	20	43	—	137	17
Hickory	27	4	3	1	—	3	—	6	19	7	11	—	16	10
Yellow birch	1	—	2	1	—	—	—	—	—	1	—	—	—	—
Hard maple	59	28	271	324	—	115	61	3	32	66	23	5	44	56
Soft maple	208	93	88	150	—	394	515	39	66	93	70	364	238	35
Ash	340	136	351	270	—	140	203	45	197	235	50	141	162	83
Balsam poplar	8	—	23	33	—	1	—	3	20	7	1	—	—	1
Paper birch	73	5	173	238	—	5	2	21	74	70	13	2	15	15
Bigtooth aspen	141	1	111	226	—	1	—	6	39	27	9	—	7	13
Quaking aspen	1,084	15	733	1,925	—	7	3	20	144	145	66	3	29	78
Basswood	276	111	718	653	—	153	41	17	242	214	89	13	191	182
Elm	562	285	837	658	—	386	252	112	483	441	173	193	506	252
Select hardwoods	—	63	—	—	—	36	—	—	16	—	71	—	152	13
Other hardwoods	—	6	—	—	—	20	—	—	—	—	6	—	117	—
Noncommercial species	331	230	39	33	—	284	368	13	64	67	39	260	224	44
Total	4,959	1,641	4,737	5,383	—	1,745	1,577	741	2,535	2,584	1,756	1,015	5,059	1,346
All species	5,551	1,652	5,115	6,232	—	1,757	1,590	745	2,550	2,990	1,772	1,033	5,074	1,374

Table 44.— *Timber removals from growing stock and sawtimber on commercial forest land by item and species group, Central Hardwood Unit, Minnesota, 1976*

Item	Growing stock						Sawtimber					
	All species	Jack pine	Spruce	Other soft-woods	Aspen	Other hard-woods	All species	Jack pine	Spruce	Other soft-woods	Aspen	Other hard-woods
	Thousand cubic feet						*Thousand board feet*[1]					
Roundwood products:												
Pulpwood	2,142	260	—	8	1,566	308	4,374	523	—	19	3,643	189
Saw logs	4,775	131	3	75	537	4,029	25,511	657	13	431	2,190	22,220
Fuelwood	3,312	70	—	39	337	2,866	4,649	97	—	51	467	4,034
Posts	205	—	—	6	4	195	416	—	—	1	10	405
Veneer logs	302	—	—	—	1	301	1,973	—	—	—	5	1,968
Poles	—	—	—	—	—	—	—	—	—	—	—	—
Other[2]	1,319	—	—	—	1,156	163	7,491	—	—	—	6,485	1,006
All products	12,055	461	3	128	3,601	7,862	44,414	1277	13	502	12,800	29,822
Logging residue	893	9	—	2	132	750	2,222	3	—	4	342	1,873
Other removals	21,249	14	38	684	1,809	18,704	35,366	16	45	906	1,418	32,981
Total removals	34,197	484	41	814	5,542	27,316	82,002	1,296	58	1,412	14,560	64,676

[1]International ¼-inch rule.
[2]Includes match bolts, particleboard bolts, shavings bolts, piling, lath bolts, etc.

Table 45.— *Timber removals from growing stock by ownership class and softwoods and hardwoods, Central Hardwood Unit, Minnesota, 1976*

(In thousand cubic feet)

Ownership class	Total	Soft-woods	Hard-woods
National forest	—	—	—
Other federal	269	8	261
State	1,052	63	989
County	37	—	37
Forest industry	—	—	—
Farmer and miscellaneous private	32,839	1,268	31,571
All ownerships	34,197	1,339	32,858

Table 46.— *Timber removals from sawtimber by ownership class and softwoods and hardwoods, Central Hardwood Unit, Minnesota, 1976*

(In thousand board feet)[1]

Ownership class	Total	Soft-woods	Hard-woods
National forest	—	—	—
Other federal	578	34	544
State	2,516	154	2,362
County	73	—	73
Forest industry	—	—	—
Farmer and miscellaneous private	78,835	2,578	76,257
All ownerships	82,002	2,766	79,236

[1]International ¼-inch rule.

Table 47.— *Annual mortality of growing stock on commercial forest land by species and cause, Central Hardwood Unit, Minnesota, 1976*

(In thousand cubic feet)

Species	All causes	Cause			
		Disease	Fire	Weather	Unknown and other
SOFTWOODS:					
White pine	70	—	70	—	—
Red pine	—	—	—	—	—
Jack pine	118	—	118	—	—
White spruce	—	—	—	—	—
Black spruce	—	—	—	—	—
Balsam fir	—	—	—	—	—
Tamarack	593	367	—	226	—
Northern white-cedar	—	—	—	—	—
Other softwoods	—	—	—	—	—
Total	781	367	188	226	—
HARDWOODS:					
Select white oaks	429	429	—	—	—
Select red oaks[1]	1,915	936	—	463	302
Other red oaks	—	—	—	—	—
Hickory	—	—	—	—	—
Yellow birch	—	—	—	—	—
Hard maple	—	—	—	—	—
Soft maple	—	—	—	—	—
Ash	797	—	159	638	—
Balsam poplar	—	—	—	—	—
Paper birch	—	—	—	—	—
Bigtooth aspen	1,052	711	—	341	—
Quaking aspen	6,515	1,762	2,096	2,034	623
Basswood	687	—	—	687	—
Elm	4,405	4,405	—	—	—
Select hardwoods	223	223	—	—	—
Other hardwoods	479	—	—	207	272
Noncommercial species	—	—	—	—	—
Total	16,502	8,466	2,255	4,370	1,197
All species	17,283	8,833	2,444	4,595	1,197

[1]214,000 cubic feet of select red oaks were killed by logging.

Table 48.— *Annual mortality of sawtimber stock on commercial forest land by species and cause, Central Hardwood Unit, Minnesota, 1976*

(In thousand board feet)[1]

Species	All causes	Cause			
		Disease	Fire	Weather	Unknown and other
SOFTWOODS:					
White pine	444	—	444	—	—
Red pine	—	—	—	—	—
Jack pine	286	—	286	—	—
White spruce	—	—	—	—	—
Black spruce	—	—	—	—	—
Balsam fir	—	—	—	—	—
Tamarack	1,998	1,998	—	—	—
Northern white-cedar	—	—	—	—	—
Other softwoods	—	—	—	—	—
Total	2,728	1,998	730	—	—
HARDWOODS:					
Select white oaks	1,624	1,624	—	—	—
Select red oaks	7,406	4,890	—	2,516	—
Other red oaks	—	—	—	—	—
Hickory	—	—	—	—	—
Yellow birch	—	—	—	—	—
Hard maple	—	—	—	—	—
Soft maple	—	—	—	—	—
Ash	2,740	—	—	2,740	—
Balsam poplar	—	—	—	—	—
Paper birch	—	—	—	—	—
Bigtooth aspen	3,441	1,808	—	1,633	—
Quaking aspen	15,988	5,642	2,912	5,197	2,237
Basswood	3,253	—	—	3,253	—
Elm	22,685	22,685	—	—	—
Select hardwoods	—	—	—	—	—
Other hardwoods	—	—	—	—	—
Noncommercial species	—	—	—	—	—
Total	57,137	36,649	2,912	15,339	2,237
All species	59,865	38,647	3,642	15,339	2,237

[1]International ¼-inch rule.

Table 49.— *Annual mortality of growing stock and sawtimber on commercial forest land by ownership class and softwoods and hardwoods, Central Hardwood Unit, Minnesota, 1976*

Ownership class	Growing stock			Sawtimber		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	Thousand cubic feet			*Thousand board feet*[1]		
National Forest	—	—	—	—	—	—
Bureau of Land Mgmt.	—	—	—	—	—	—
Indian	—	—	—	—	—	—
Miscellaneous federal	364	—	364	1,039	—	1,039
State	1,311	188	1,123	3,162	730	2,432
County and municipal	1,935	—	1,935	3,698	—	3,698
Forest industry	—	—	—	—	—	—
Farmer	10,829	593	10,236	40,327	1,998	38,329
Farmer-owned leased	—	—	—	—	—	—
Misc. private-corp.	454	—	454	2,425	—	2,425
Misc. private-indiv.	2,390	—	2,390	9,214	—	9,214
Misc. priv.-corp., leased	—	—	—	—	—	—
Misc. priv.-ind., leased	—	—	—	—	—	—
All owners	17,283	781	16,502	59,865	2,728	57,137

[1]International ¼-inch rule.

Table 50.— *Output of timber products by source of material and softwoods and hardwoods, Central Hardwood Unit, Minnesota, 1975*

Product and species group	Standard Unit	Total		Roundwood products				Plant byproducts	
				Growing stock		Nongrowing stock			
		No. of units	*Thousand cubic feet*	*No. of units*	*Thousand cubic feet*	*No. of units*	*Thousand cubic feet*	*No. of units*	*Thousand cubic feet*
Pulpwood:	Standard								
Softwood	cords[1]	3,631	286	3,402	258	229	18	—	—
Hardwood		33,324	2,634	23,707	1,874	3,188	252	6,429	508
Total		36,955	2,920	27,109	2,142	3.417	270	6,429	508
Fuelwood:	Standard								
Softwood	cord[1]	3,949	273	1,579	109	2,013	139	357	25
Hardwood		113,239	7,828	46,367	3,203	60,843	4,203	6,029	422
Total		117,188	8,101	47,946	3,312	62,856	4,342	6,386	447
Posts:	Thousand								
Softwood	pieces	7	6	7	6	—	—	—	—
Hardwood		315	321	195	199	120	122	—	—
Total		322	327	202	205	120	122	—	—
Veneer logs:	[2]Thousand								
Softwood	board feet	—	—	—	—	—	—	—	—
Hardwood		2,076	334	1,877	302	199	32	—	—
Total		2,076	334	1,877	302	199	32	—	—
Poles:	Pieces								
Softwood		—	—	—	—	—	—	—	—
Hardwood		—	—	—	—	—	—	—	—
Total		—	—	—	—	—	—	—	—
Saw logs:	[2]Thousand								
Softwood	board feet	1,173	214	1,146	209	27	5	—	—
Hardwood		27,434	4,685	26,737	4,566	697	119	—	—
Total		28,607	4,899	27,883	4,775	724	124	—	—
Other:[3]	Thousand								
Softwood	cubic feet	9	9	—	—	—	—	9	9
Hardwood		1,953	1,953	1,319	1,319	32	32	602	602
Total		1,962	1,962	1,319	1,319	32	32	611	611
All products:	Thousand								
Softwood	cubic feet	788	788	592	592	162	162	34	34
Hardwood		17,755	17,755	11,463	11,463	4,760	4,760	1,532	1,532
Total		18,543	18,543	12,055	12,055	4,922	4,922	1,566	1,566

[1]Rough-wood, 128 cubic feet basis.
[2]International ¼-inch rule.
[3]Other (industrial production) includes match bolts, shaving bolts, particleboard bolts, lath bolts, piling, etc.

Table 51.—*Forest products harvested, by ownership class and product, Central Hardwood Unit, Minnesota, 1975*

Ownership Class	Pulpwood	Saw logs	Fuelwood	Posts	Poles	Other
	Cords[1]	*[2] Thousand board feet*	*Cords*[1]	*Thousand pieces*	*Pieces*	*Thousand cubic feet*
FEDERAL:						
National forest:						
Softwoods	—	—	—	—	—	—
Hardwoods	—	—	—	—	—	—
Total	—	—	—	—	—	—
Other federal:						
Softwoods	5	33	50	—	—	—
Hardwoods	3,352	52	266	—	—	—
Total	3,357	85	316	—	—	—
STATE:						
Softwoods	515	66	26	—	—	—
Hardwoods	6,437	880	406	—	—	2
Total	6,952	946	432	—	—	2
COUNTY:						
Softwoods	—	—	—	—	—	—
Hardwoods	405	7	188	—	—	—
Total	405	7	188	—	—	—
PRIVATE:						
Forest industry:						
Softwoods	—	—	—	—	—	—
Hardwoods	—	—	—	—	—	—
Total	—	—	—	—	—	—
Farm and other:						
Softwoods	3,111	1,074	3,516	7	—	—
Hardwoods	16,701	26,495	106,350	315	—	1,683
Total	19,812	27,569	109,866	322	—	1,683
All owners:						
Softwoods	3,631	1,173	3,592	7	—	—
Hardwoods	26,895	27,434	107,210	315	—	1,685
Total	30,526	28,607	110,802	322	—	1,685

[1]Rough-wood, 128 cubic feet basis.
[2]International ¼-inch rule.

Table 52.— *Volume of primary plant residue by kind of material and type of use, Central Hardwood Unit, Minnesota, 1975*

(In thousand cubic feet)

Type of use	Total		Kind of wood residue					
			Coarse[1]		Fine[2]		Bark[3]	
	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood
Fiber products[4]	5.3	902.8	5.3	902.8	—	—	—	72.4
Charcoal	—	157.1	—	157.1	—	—	—	62.0
Industrial fuel	—	7.9	—	6.4	—	1.5	—	6.6
Domestic fuel	25.0	413.8	22.4	246.3	2.6	167.5	14.9	71.3
Miscellaneous[5]	9.4	445.2	.3	22.3	9.1	422.9	.2	385.4
Not used[6]	6.3	290.8	1.0	21.7	5.3	269.1	3.9	544.3
Total	46.0	2,217.6	29.0	1,356.6	17.0	861.0	19.0	1,142.0

[1]Suitable for chipping such as slabs, edgings, veneer cores, etc.
[2]Not suitable for chipping such as sawdust, veneer clippings, etc.
[3]Does not include bark disposal at pulpmills.
[4]For manufacture of pulp, hardboard or roofing felt.
[5]Livestock bedding, mulch, small dimension, and speciality items.
[6]Includes residue burned as waste.

Table 53.— *Timber products output from roundwood by species and product, Central Hardwood Unit, Minnesota, 1975*

Species	Sawlogs		Veneer logs		Pulpwood		Fuelwood		Posts		Other Products	All Products
	Thousand board feet[1]	*Thousand cubic feet*[2]	*Thousand board feet*[1]	*Thousand cubic feet*[2]	*cords*[3]	*Thousand cubic feet*[2]	*Cords*	*Thousand cubic feet*[2]	*Thousand pieces*	*Thousand cubic feet*[2]	*Thousand cubic feet*[2]	*Thousand cubic feet*[2]
SOFTWOODS:												
White pine	127	21	—	—	—	—	200	10	—	—	—	31
Red pine	282	48	—	—	—	—	—	—	—	—	—	48
Jack pine	714	136	—	—	3,519	278	2,313	163	—	—	—	577
Spruce	14	3	—	—	—	—	—	—	—	—	—	3
Balsam fir	22	4	—	—	—	—	—	—	—	—	—	4
Tamarack	6	1	—	—	112	8	1,079	75	7	6	—	90
Northern white-cedar	8	1	—	—	—	—	—	—	—	—	—	1
Total	1,173	214	—	—	3,631	286	3,592	248	7	6	—	754
HARDWOODS:												
White oak	3,073	511	19	2	—	—	10,566	735	196	200	56	1,504
Red oak	11,514	1,931	683	110	2,818	224	39,580	2,771	108	117	10	5,163
Hickory	78	13	—	—	—	—	200	3	—	—	—	202
Yellow birch	—	—	—	—	—	—	154	7	—	—	—	7
Cottonwood	787	134	254	40	—	—	200	1	—	—	—	175
Hard maple	654	108	228	37	—	—	817	42	—	—	15	202
Soft maple	396	64	128	20	—	—	308	11	—	—	—	95
Ash	831	140	16	2	—	—	15,691	1,091	—	—	—	1,233
Balsam poplar	490	86	—	—	—	—	1,542	108	3	—	—	194
Paper birch	125	19	—	—	1,451	116	9,598	658	—	—	—	793
Aspen	2,946	543	5	1	22,626	1,786	11,131	773	8	4	1,179	4,286
Basswood	2,120	367	344	56	—	—	2,217	133	—	—	37	593
Elm	4,115	720	286	47	—	—	14,525	1,026	—	—	54	1,847
Black walnut	201	32	107	18	—	—	—	—	—	—	—	50
Other hardwoods	104	17	6	1	—	—	771	47	—	—	—	65
Total	27,434	4,685	2,076	334	26,895	2,126	107,210	7,406	315	321	1,351	16,223
All species	28,607	4,899	2,076	334	30,526	2,412	110,802	7,654	322	327	1,351	16,977

[1]International ¼-inch rule.
[2]Small quantities may round off to less than 500 cubic feet and will be shown as a dash in columns showing thousand cubic feet.
[3]Rough-wood, 128 cubic feet basis.

Table 54.— *Sampling errors[1] for estimates smaller than Unit totals of volume, net growth, and removals and of area of commercial forest land in Minnesota's Central Hardwood Unit, 1977*

Sampling error	Commercial forest area	Growing stock			Sawtimber		
		Inventory	Growth	Removals	Inventory	Growth	Removals
Percent	*Thousand acres*	*Million cubic feet*			*Million board feet*		
1	4,088.7	6,805.1	724.8	2,511.8	41,179.8	1,663.7	4,861.8
2	1,022.2	1,701.3	181.2	628.0	10,294.9	415.9	1,215.4
3	454.3	756.1	80.5	279.1	4,575.5	184.9	540.2
4	255.5	425.3	45.3	157.0	2,573.7	104.0	303.9
5	163.6	272.2	29.0	100.5	1,647.2	66.5	194.5
10	40.9	68.1	7.2	25.1	411.8	16.6	48.6
15	18.2	30.2	3.2	11.2	183.0	7.4	21.6
20	10.2	17.0	1.8	6.3	102.9	4.2	12.2
25	6.5	10.9	1.2	4.0	65.9	2.7	7.8
50	1.6	2.7	0.3	1.0	16.5	0.7	1.9
100	0.4	0.7	0.1	0.3	4.1	0.2	0.5

[1]At the 68 percent probability level.

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Vasilevsky, Alexander, and Ronald L. Hackett.

1980. Timber resource of Minnesota's Central Hardwood Unit, 1977. U.S. Department of Agriculture Forest Service, Resource Bulletin NC-46, 65 p. U.S. Department of Agriculture Forest Service, North Central Forest Experiment Station, St. Paul, Minnesota.

The fourth inventory of Minnesota's Central Hardwood Unit shows large gains in growing-stock and sawtimber volumes but a 17-percent decline in commercial forest area between 1962 and 1977. This report gives statistical highlights and contains detailed tables of forest area as well as timber volume, growth, mortality, ownership, and use.

KEY WORDS: timber volume, growth, utilization, forest area.

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